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Biological Assessment

McCormick and Baxter Creosoting Company Portland, Oregon

DEQ
State of Oregon
Department of Environmental Quality

United States Environmental Protection Agency

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U.S. Environmental Protection Agency
Oregon State Department of Environmental Quality

Document Purpose

This document is the Environmental Protection Agency's (EPA) evaluation of potential effects from a proposed Federal action on plant and animal species covered under the Endangered Species Act (ESA). EPA intends this document to demonstrate substantive compliance with ESA pursuant to the requirements of the National Contingency Plan (NCP) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

The Federal action addressed in this document is the construction of a sheet pile and soil-bentonite slurry barrier wall around the Federal Superfund site known at the McCormick and Baxter Creosoting Company, Portland, Oregon. This action is one of several remedial actions being taken under CERCLA to significantly reduce the potential risk to human health and/or ecological receptors resulting from potential exposure to contaminants present in sediment, groundwater, and soils at the project area.

EPA is pursing this action with highest priority because construction of the barrier wall will substantially reduce the off-site migration of contaminants. Additional remedial actions will take place to address the contaminated sediments in the Willamette River and to address contaminated soils and groundwater on the upland portion of the site. These actions are still in design phases and will not likely begin construction until 2003. EPA believes that the barrier wall can be treated as an action of independent utility because containment of the upland sources of contamination is critical for any future remedial actions. This action must take place regardless of the final selection and design of the remedies for contaminated soils, groundwater, and sediments. EPA anticipates that the future construction actions will include the construction of a sediment cap on Willamette River sediments and the construction of a cap on the contaminated upland soils.

EPA has designated the lead in implementing the actions contained with the CERCLA Record of Decision (ROD) for the site to the Oregon Department of Environmental Quality (DEQ), although these remain Federal actions with Federal funding. DEQ, however, will be solely responsible for the long-term operation and maintenance of the remedies.

EPA intends this document to set the standard for evaluation of the construction of the barrier wall as well as any future remedial actions that may have an effect on threatened and endangered species in the project area. Future evaluations will be based on the same set of pathways and indicators describe herein. Future biological assessments will be addendums to this document to avoid repeating the background information contained in this submittal.

EPA also considers this as a living document in that certain design details will not be known until a selected contractor has had the opportunity to consider construction techniques. However, DEQ (on behalf of EPA) will set contractor performance standards based on the findings of this document as well as other supporting documents contained in the administrative record. Upon receipt of specific construction detail, EPA and DEQ will forward those to the National Marine Fisheries Service and the U.S. Fish and Wildlife Service for their review. EPA also expects that protective measures refined during the construction of the barrier wall may be applied to any future construction work.

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1. SUMMARY OF FINDINGS

Remedial actions described in the Environmental Protection Agency's 1996 Record of Decision (ROD), issued in conjunction with the Oregon State Department of Environmental Quality, for the McCormick and Baxter Creosoting Company are being taken pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). These actions also are considered agency actions under the Endangered Species Act (ESA) and are therefore required to substantively comply with the ESA. The U.S. Environmental Protection Agency (EPA) determined that this biological assessment is necessary to evaluate potential effects of the proposed remedial activities on federally listed threatened and endangered species.

This biological assessment (BA) evaluates the potential effects on threatened and endangered species from the following activities that comprise the action:

- Removal of existing piling near ordinary high water (OHW) on the south side of the existing bulkhead.
- Displacement of existing shoreline woody debris near the OHW to facilitate installation of the subsurface wall (see below).
- Construction of a perimeter subsurface sheet pile wall along approximately 1170 linear feet of the Willamette shoreline all above OHW.
- Construction of a subsurface soil-bentonite slurry wall along 2380 feet of the upland portion of the property.

The Federal listed species are:

- Lower Columbia River Chinook Salmon (*Oncorhynchus tshawytscha*)
- Upper Willamette River Chinook Salmon (*Oncorhynchus tshawytscha)*
- Lower Columbia River Steelhead *(Oncorhynchus mykiss)*
- Upper Willamette River Steelhead (*Oncorhynchus mykiss)*
- Columbia River Chum Salmon (*Oncorhynchus keta*)
- Bald Eagle (*Haliaeetus leucocephalus*)
- Golden Paintbrush (*Castilleja levisecta*)
- Water Howellia (*Howellia aquatilis*)
- Bradshaw's lomatium (*Lomatium bradshawii*)
- Nelson's checker-mallow (*Sidalcea nelsoniana*)
- Willamette daisy (*Erigeron decumbens var. decumbens*)
- Kincaid's lupine (*Lupinus sulphureus var. kincaidii*)

The Federal proposed species are:

- Southwestern Washington/Columbia River Sea-Run Cutthroat Trout *(Oncorhynchus clarki clarki)*

The Federal candidate species are:

- Lower Columbia River/Southwest Washington Coho Salmon (*Oncorhynchus kisutch)*
- Oregon spotted frog (*Rana pretiosa*).

Based on the information provided in this biological assessment, EPA concludes that the proposed action is not likely to jeopardize the continued existence of the above listed species. Furthermore, EPA believes that the long-term benefits of the remedial actions (a cleaner and more productive environment) will aid in the recovery of federally listed threatened and endangered species. However, EPA acknowledges that the remedial actions will result in the short-term disruption of the use of aquatic habitat at the project site. Therefore, EPA determined the following effects for each species.

Listed Species

- Lower Columbia River Chinook Salmon - May affect, likely to adversely affect
- Upper Willamette River Chinook Salmon – May affect, likely to adversely affect
- Lower Columbia River Steelhead – May affect, likely to adversely affect
- Upper Willamette River Chinook Salmon – May affect, likely to adversely affect
- Columbia River Chum Salmon – May affect, likely to adversely affect
- Bald Eagle - May affect, not likely to adversely affect
- Golden Paintbrush – No effect
- Water Howellia – No effect
- Bradshaw's lomatium – No effect
- Nelson's checker-mallow – No effect
- Willamette daisy – No effect
- Kincaid's lupine – No effect

Proposed Species

- Southwestern Washington/Lower Columbia River Sea-Run Cutthroat Trout – Will not result in jeopardy

Candidate Species

- Lower Columbia River/Southwest Washington Coho Salmon – Will not result in jeopardy
- Oregon Spotted Frog – Will not result in jeopardy

EPA has included a description of conservation measures that will be used to minimize effects to the species of concern during construction (see Section 18). In addition, EPA will continue consulting with National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) during design to ensure that appropriate actions are taken to address ESA concerns.

2. INTRODUCTION

This document covers the biological assessment of federally listed species under the Endangered Species Act for remedial actions at the McCormick and Baxter Superfund Site. In performing this evaluation, EPA has focused attention to anadromous fishes. Furthermore, EPA has taken a phased approach in implementing the remaining remedial actions. Following is a discussion of the evaluation approach and a discussion of the proposed actions.

2.1 Evaluation Approach

The following discussion focuses on the anadromous fishes because of the nature of the proposed in-water work. The other listed non-fish species are discussed in detail in Section 19. The anadromous fish species include five Evolutionarily Significant Units (ESU) identified by NFMS and one Distinct Population Segment (DPS) identified by the USFWS. An additional species ESU is a candidate for listing and is also included in this document. Table 1 includes status, listing dates, and critical habitat for each anadromous fish species.

Table 1
Status, Listing Dates and Critical Habitat of Anadromous Fish Species

ESU	Status	Date Listed	Critical Habitat
Lower Columbia River Chinook	Threatened	3/24/99	Columbia River, estuary and tributaries from Grays and White Salmon River to Willamette and Hood Rivers
Upper Willamette River Chinook	Threatened	3/24/99	Columbia River and estuary, Clackamas and Willamette Rivers, and tributaries above Willamette Falls
Lower Columbia River Steelhead	Threatened	3/19/98	Columbia River, estuary, and tributaries between Cowlitz and Wind Rivers in WA, Willamette and Hood Rivers in OR
Upper Willamette River Steelhead	Threatened	3/25/99	Columbia River and estuary to Willamette River, Willamette River and tributaries above Willamette Falls up to Calapooia River
Columbia River Chum	Threatened	3/25/99	Columbia River, estuary and tributaries downstream from Bonneville Dam
Lower Columbia River/SW Washington Coho	Candidate	NA	NA
DPS			
Southwest Washington/Columbia River Coastal Cutthroat Trout	Proposed Threatened	10/25/99	NA

2.2 Description of the Actions

The remedial actions remaining to be implemented at the McCormick and Baxter site include the construction of a subsurface, impermeable barrier wall around the primary contaminant release area, the placement of capping and erosion control materials over contaminated sediments in the Willamette River and the placement of a soil cap over the entire uplands portion of the site.

Actual or threatened releases of hazardous substances from the McCormick and Baxter site, if not addressed, represent an imminent and substantial endangerment to public health, welfare, or the environment. These hazardous substances have contaminated the groundwater, surface waters, upland soil, and the sediment of the Willamette River. The threat from contaminated sediment is through exposure of benthic communities living at or near the sediment-water interface, fish that feed on benthic organisms or live in close association with surface sediment, humans who consume organisms that have been exposed to the sediment and have accumulated contaminants, and direct contact by humans.

EPA has phased the remedial actions to first contain nonaqueous phase liquid (NAPL) from migrating into the river and sediments prior to constructing the sediment cap. The subsurface barrier wall is critical to control the offsite migration of (mobile) NAPL. The design of the barrier wall is approximately 90 percent complete (pending the results of the Section 7 consultation process). As such, EPA has determined that it will submit a separate biological assessment for the construction of the barrier wall and will submit an additional biological assessment upon completion of an intermediate design (approximately 60 percent) for the Willamette River sediment remedy and the soil cap. EPA believes these actions can be treated separately in that containment of NAPL is central to any successful remedy at McCormick and Baxter and does not irrevocably commit EPA to any single design for the sediment and soil caps.

The activities covered by this BA are the following:

- Removal of existing piling near ordinary high water (OHW) on the south side of the existing bulkhead.
- Displacement of existing shoreline woody debris near the OHW to facilitate installation of the wall
- Construction of a perimeter sheet-pile wall along approximately 1170 linear feet of the Willamette shoreline, all of which will be above OHW.
- Construction of 2380 feet of slurry wall encompassing the upland portions of the property. The sheet pile and slurry walls will connect together at the north and south upland 'wings' of the sheet pile wall.

3. BACKGROUND INFORMATION ON PROJECT SITE

3.1 Site Location and Physical Characteristics

The McCormick and Baxter site is situated on the west bank of the Willamette River at River Mile 7 (see Figure 1). The site is located at 6900 Edgewater Street in the City of Portland, Oregon and consists of approximately 43 acres of uplands (dry land) and 17 acres of contaminated sediments (see Figure 2). An additional 5 acres is comprised of the steeply sloping riverbank between the river and the uplands. The upland portion of the site is generally flat and located at an elevation of 29 to 33 feet above the National Geodetic Vertical Datum (NGVD), which is used as a control for the (upland) site topographic survey. The McCormick and Baxter site is zoned for heavy industrial use but has been vacant since the early 1990s. The site is bordered by railroad tracks to the northeast and northwest, a barge maintenance and dredging facility to the southeast, and an empty lot where a shipyard and cooperage were once located on the northwest. Nearly all the infrastructure has been removed from the McCormick and Baxter site and adjacent industrial properties, and these areas generally have returned to a more natural setting with grasses, shrubs and some trees. A residential area is located on the northwest side of the site on top of a bluff approximately 120 feet high. This bluff is a designated greenspace by the City of Portland, and mature vegetation including large trees is abundant.

The Willamette River is about 1500 feet wide along the reach of the project site and flows to the northwest. Channel sounding maps produced by the U.S. Army Corps of Engineers (COE) from January 1991 show a channel width of approximately 600 feet and a maximum depth of approximately 60 to 70 feet below the Columbia River Datum (CRD). The CRD is approximately 1.74 feet above the NGVD. There is a 50-foot wide embayment along the south portion of the property, with river depths ranging from +10 to –25 feet NGVD. COE maps indicate that there are steep slopes to the dredged navigational channel approximately 150 feet offshore (or 300 feet from the embayment shoreline).

3.2 Administrative History

The McCormick and Baxter site was proposed for addition to the National Priorities List (NPL) on June 18, 1992 and was added to the NPL on June 1, 1994. After a detailed study of the nature and extent of contamination at the site and a detailed analysis of cleanup alternatives, EPA, in conjunction with DEQ, signed a Record of Decision (March 1996), which identified the selected remedy for the McCormick and Baxter site. A complete description of the prior site history and enforcement activities is included in the ROD. The ROD addressed the contaminated soil, groundwater, and sediment.

The selected remedy is a series of remedial actions that address the human and environmental health threats at the site by treating the most highly contaminated soil, capping lesser contaminated soil, extracting nonaqueous phase liquid NAPL, installing a subsurface barrier wall as a contingency, and capping contaminated sediments. Several of these actions have been completed or are ongoing. A ROD Amendment was issued in 1997 and changed the treatment requirement for highly contaminated soil to off-site disposal at a permitted landfill. EPA anticipates that an Explanation of Significant Difference (ESD) will be issued in June 2002 and provide the justification and basis for invoking the barrier wall contingency.

3.3 Nature and Extent of Contamination

The McCormick and Baxter Creosoting Company operated between 1944 and 1991, treating wood products with creosote, pentachlorophenol, and inorganic (arsenic, copper, chromium and zinc) preservative solutions. Historically, process wastes were disposed of in several areas of the site, including the Formal Waste Disposal Area (FWDA). In addition, there were periodic spills and leaks of wood-treating chemicals in the Tank Farm Area (TFA) and Central Process Area (CPA). Significant concentrations of wood-treating chemicals are now present in groundwater beneath the site (see Figure 2).

The source areas and nature and extent of contamination in sediment are discussed in detail in the ROD. A discussion of contaminant source areas and the nature and extent of contamination also is presented in the *Sediment Cap Basis of Design* report (DEQ 2002).

3.3.1 Groundwater Contamination

The main site-related groundwater contaminants are PAHs, PCP, and metals associated with wood-treating solutions. The main source areas of the groundwater contamination include the TFA, the FWDA, and the CPA. Wood-treating products (i.e., containing PAHs) generally have low to moderate solubility in water, and they either float on the water table or continue to sink depending on the density of the product compared to that of the water. These relatively insoluble materials commonly are described as nonaqueous phase liquids (NAPL). NAPL that floats is referred to as lighter-than-water nonaqueous phase liquid (LNAPL), and NAPL that is heavier than water and sinks is referred to as denser-than-water nonaqueous phase liquid (DNAPL). The density of DNAPL at this site is close to that of water and tends to be suspended throughout the water column or aquifer thickness. LNAPL is predominantly found at the water surface without much vertical suspension. Groundwater quality at the site also has been impacted by dissolved-phase contaminants.

Releases of NAPL contaminants from the main source areas at the site, particularly from the TFA and FWDA, mainly have affected the shallow aquifer. Two distinct NAPL plumes are present at the site: one in the TFA and one in the FWDA. These contaminant plumes contain LNAPL and DNAPL or both that consist of creosote compounds; the plumes also contain dissolved-phase contaminants.

The FWDA NAPL plume is estimated to affect approximately 4 acres of soil and 5 acres of sediment. The contaminants in this plume originated from waste oil, stormwater from system pits, and other liquid wastes that were disposed of in the FWDA. This mixture of contaminants migrated vertically to the water table (approximately 30 feet below ground surface (bgs)) and then laterally toward the river, spreading as LNAPL and DNAPL.

The TFA plume is estimated to affect approximately 8 acres of soil and 6 acres of sediment. The contaminants in this plume originated from the former tank farm, the large creosote tank, the creosote retorts, the butt tanks, and the southeast waste disposal trench, in which either periodic spills or disposal of waste oils (creosote and PCP) and other liquid wastes occurred. This mixture of contaminants migrated vertically to the water table (approximately 30 feet bgs) and then laterally toward the river, spreading as LNAPL and DNAPL. Near the beach, LNAPL occasionally has been observed in seeps at low tides and at low river stage (i.e., generally during late summer).

Contaminant flux from shallow aquifer groundwater to river sediment still is occurring at the site downgradient from the FWDA and TFA plumes. The groundwater gradient direction in the shallow, intermediate, and deep zones is generally from the bluff toward the river. However, periodic reversals of the groundwater gradient occur near the shoreline. As previously discussed, contaminated groundwater can be observed in beach seeps during late summer when the river stage is low and hydrostatic pressures decrease, allowing NAPL and contaminated groundwater to enter the river sediment.

3.3.2 Sediment Contamination

Sediment sampling was initiated in the early 1990s during the Remedial Investigation (RI). Results indicated that the contamination could be correlated to the NAPL plumes emanating from the TFA and FWDA. Subsurface sample data indicate that contamination may extend as deep as 35 feet bgs in heavily contaminated areas. RI studies concluded that NAPL, when present, was found in the upper 7 feet of the sediment and that NAPL discharge, as indicated by an oily sheen or beach seeps, appeared to be greatest during river stages of -3 CRD or lower.

Additional sediment sampling and analyses were conducted in 1999 and 2001. The sample locations included sites in the vicinity of the former creosote dock where spillage occurred during off-loading procedures. The results indicated that carcinogenic PAHs and dioxin/furan compounds contaminate sediments at the McCormick and Baxter site. Bioassay tests resulted in significant mortality to test organisms at a number of sampling locations.

Based on evaluation of the 1999 and 2001 sediment sampling results, the following general conclusions can be reached:

- High concentrations of PAHs were detected in samples collected where LNAPL releases are known or are suspected to be occurring (i.e., near the creosote dock, downstream into Willamette Cove, and along the sediment drop-off along the harbor line);
- PAH concentrations appear to decline rapidly away from known or suspected NAPL release areas, suggesting little lateral spreading of PAH-contaminated sediment; and
- Concentrations of other contaminants of concern generally did not exceed ROD cleanup levels, and sediment testing for PAHs is a generally reliable indicator to define the area to be capped due to chemical contamination.

During an extreme low-water period in August 2001, a NAPL seep emerged at Willamette Cove that had not been observed previously, except as an occasional sheen. Drought conditions and an extremely low river water level may have led to the emergence of the seep. The location of the seep is in the predicted downgradient direction from the FWDA and comparison of ratios of LPAH to high-molecular-weight polynuclear aromatic hydrocarbon (HPAH) between seep sediment samples and on-site subsurface soil samples appear to verify that the FWDA is the source of this NAPL contamination.

3.3.3 Soil Contamination

The ROD provided two sets of criteria for soil based on the cost-effectiveness of treatment alternatives to achieve the Remedial Action Objectives (RAOs). Highly contaminated soil required treatment, which was later amended to removal. Residually contaminated soil could remain on site but measures were required to prevent direct contact, ingestion, or surface runoff containing contaminated soil.

In 1996 and 1997, extensive surface (0 to 6 inches bgs) and subsurface (4 and 10 feet bgs) soil samples were collected and analyzed in anticipation of excavating and treating the most heavily contaminated soil. Removal of the highly contaminated soil began in March 1999 and was completed in May 1999. Approximately 33,000 tons of contaminated soil and debris were removed from the site and disposed of in a permitted, hazardous waste landfill in Idaho. The *Revised Final Remedial Design Data Summary Report* (DEQ 1998) depicted the locations of the residually contaminated surface soil and concluded that the entire upland area of the site should be capped.

3.4 Description of the Proposed Action (Construction of the Barrier Wall)

The proposed action addressed in this BA is the construction of the subsurface barrier wall which consists of the removal of existing wooden pilings, the displacement of large woody debris along the shoreline to facilitate sheet pile wall construction, the construction of the sheet pile wall along the OHW of the Willamette River, and construction of a slurry wall on the upland portion of the site (see Figures 3, 4 and 5).

The wood pilings will be removed at the sediment surface, either by cutting or pulling and will be transported to a suitable upland location for eventual disposal (either on-site or off-site). The disposition of the wood pilings will be determined during design of the uplands soil cap.

The woody debris along the shoreline may need to be relocated a short distance away from its existing location to allow sheet pile wall construction; the piles cannot be driven through wood. No woody debris would be removed from the site and it will be moved by heavy equipment from the upland portion of the shoreline to the minimal amount of distance necessary to allow sheet pile construction.

The sheet pile wall will be 1270 linear feet and will be an all steel structure. The sheet pile will be driven with a compression hammer or a vibratory hammer (or both) and will be driven flush with the surface.

The upland slurry wall will be constructed by excavating a 3-foot wide by 2380-foot long trench to depths up to approximately 80 feet bgs. As the trench is excavated, it will be immediately backfilled with a bentonite-water slurry and a soil-bentonite mixture, which forms an impermeable barrier wall. The finished slurry wall will also be capped with soils to be flush with the existing ground surface. The slurry will not come within 100 feet of the banks and shoreline of the Willamette River. Construction techniques will not result in any interface with or potential discharges to the aquatic environment. Although the site is adjacent to the Willamette River, only a small portion of the site has experienced flooding (the southeast corner) during the highest flood of record, which occurred in 1996 (see Figure 6). As such, no interface of the materials used during construction of the slurry will occur with surface waters. In addition, all construction stormwater will be restricted to the construction site with no discharges to surface waters.

3.5 Duration and Timing of the Action

Construction of the barrier wall is subject to concurrence of the natural resource services on this BA, completion of EPA's obligation for consultation with Tribal Nations, completion of EPA's consultation consistent with the National Historic Preservation Act, completion of the final design of the barrier wall and related construction documents, availability of Federal funds, and procurement of a construction contractor by DEQ. The tentative schedule is to begin construction of the slurry wall in October 2002 followed by construction of the sheet pile wall in January 2003. Construction of the soil slurry wall is anticipated to require approximately 8 to 10 weeks and construction of the sheet pile wall is anticipated to require approximately 12 weeks. All construction work is anticipated to be completed by April 2003.

4. DESCRIPTION OF ACTION AREA

An action area is defined by NMFS regulations (50 CFR Part 402) as 'all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved by the action.' The action area for the proposed action includes the entire portion of the Willamette River from RM 8 to the confluence of the Columbia River, including the exposed beach and shoreline areas.

The Willamette River is one of the major rivers in Oregon with a watershed of 12,000 square miles. It is a major tributary to the Columbia River, which it joins approximately 7 miles to the north of the site. The river is tidally influenced at the project site.

The Willamette River is about 1500 feet wide along the reach of the project site and flows to the northwest. Channel sounding maps produced by the U.S. Army Corps of Engineers from January 1991 the show a channel width of approximately 600 feet and a maximum depth of approximately 60 to 70 feet below the CRD. There is a 50-foot wide embayment along the south portion of the property, with river depths ranging from +10 to –25 feet NGVD. COE maps indicate that there are steep slopes to the dredged navigational channel approximately 150 feet offshore (or 300 feet from the embayment shoreline).

The City of Portland surrounds the action area. Most of the shorelines of the Willamette and the Columbia Rivers are developed as industrial shorelines, although there are areas of greenbelt, residential, and commercial use.

4.1 Historic Conditions

European settlement of the Willamette Basin in the early 1800s began a history of substantial changes to the river ecosystem. Although some impacts were the result of naturally occurring events, the principal impacts in the Willamette Basin are from human activities. The most extensive changes in characteristics of the Willamette River occurred as a result of channelization and containment of the main stem (Sedell and Frogatt 1984). These changes were greatest in the southern half of the river, which historically was a braided system of numerous oxbows, sloughs, ponds, and small side-channels and a broad floodplain with extensive marshlands and riparian gallery forests. Additional habitat loss occurred due to clearing of the extensive riparian forests and draining and filling of wetland habitats (Holland 1994).

Declining anadromous fish stocks in the Willamette Basin and elsewhere in the Pacific Northwest have been attributed to numerous factors, including loss and degradation of freshwater and riparian habitat, introduction of non-native fish species; construction and operation of dams and their effects on habitat, water flows, temperature predation, mortality, and passage; and management of land uses, such as timber harvesting, grazing, and agriculture. Wevers (1994) estimates that approximately 16 million wild salmon and steelhead were produced annually in the Columbia Basin (including the Willamette Basin) 120 years ago. This compares to the approximately 2 million produced today, about 80 percent of which are hatchery fish.

Like the rest of the Willamette River, the action area once supported extensive braided channels, back channels, and marshes. The braided channels and high sediment load were indicative of large seasonal flood events and occasional catastrophic flood events. The low-elevation confluence areas likely supported riparian gallery forests, dominated by black cottonwood (*Populus balsimifera*), red alder (*Alnus rubra*) and red maple (*Acer macrophylum*). These forests would also be indicative of a dynamic, fluctuating river system.

The variability and unregulated river flow resulted in a myriad of conditions and habitat types in the action area. The river likely carried large loads of woody debris and the braided channels provided extensive shallow water habitat with sloping shorelines. The differing bathymetry of the river channel provided pools and backwaters and a variety of water temperature conditions. Adjacent riparian forests and wetlands provided extensive organic detritus and also provided habitat for terrestrial insects, birds and wildlife. During flooding events, the adjacent riparian areas and wetlands also provided feeding and resting areas for migrating fish.

The action area is unique along the Willamette River because it experiences daily tidal fluctuations (lower Willamette River up to Willamette Falls). This allowed for even greater diversity of habitats, including freshwater tidal marshes and forested tidelands in the upper reaches of the flood plain.

There are no estimates of habitat loss for this section of the Willamette. However, the extensive filling for urban and industrial development suggests that most of the area supported wetlands and riparian forests as well as braided channels, back channels, oxbows and other features associated with a dynamic river system.

4.2 Current Conditions

The lower Willamette River has been altered to accommodate urban development and a growing shipping industry. Development in the harbor has replaced the natural shoreline with riprap, bulkheads, and other artificial structures, and sand-beach lagoons. Because of navigational dredging by the U.S. Army Corps of Engineers, the river has a steeply sloped, silt and sand bottom.

Several species of anadromous fishes, including Chinook salmon, steelhead, coho salmon, sockeye salmon, American shad, and white sturgeon occur in the area. Both juveniles and adults use the study area as a migratory corridor and as rearing habitat for juveniles. Cutthroat trout are also present, but their abundance is low, particularly in the lower Willamette River (Bennett and Foster 1991, NMFS 1999).

5. EVALUATING PROPOSED ACTIONS

EPA has focused the following discussion on the listed, candidate and proposed salmonid species because the majority of the work is in migration waters for these species. An expanded discussion for other species of concern is in Section 18.

5.1 Biological Requirements of Federally Listed or Proposed Threatened or Endangered Species.

5.1.1 Chinook Salmon (*Oncorhynchus tshawytscha*)[1]

Of the Pacific salmon, Chinook salmon exhibit the most diverse and complex life history strategies (Healey 1986). The generalized life history involves incubation, hatching, and emergence in freshwater, migration to the ocean, and subsequent initiation of maturation and return to freshwater for completion of maturation and spawning. Juvenile rearing in freshwater can be minimal or extended. Additionally, some male Chinook salmon mature in freshwater, thereby foregoing emigration to the ocean. The timing and duration of each of these stages is related to genetic and environmental determinants and their interactions to varying degrees.

1 This information is summarized from Myers et al 1998.

Healey (1983, 1991) described two distinct races of Chinook salmon, "ocean-type" and "stream-type." Ocean-type Chinook salmon reside in estuaries for longer periods as fry and fingerlings than do yearling, stream-type, Chinook salmon smolts (Reimers 1971, Kjelson et al 1982, Healey 1991). Ocean- and stream-type Chinook salmon populations exhibit a distinct geographical distribution. Chinook salmon stocks in Asia, Alaska, and Canada north of the 55th parallel, and in the headwaters (upper elevations) of the Fraser River and the Columbia River Basins, exhibit a stream-type life history: emigrating to sea in their second or third spring and generally entering freshwater several months prior to spawning (Healey 1991). Ocean-type Chinook salmon are predominant in coastal regions south of 55N, in Puget Sound, in the lower reaches of the Fraser and Columbia Rivers, and in California's Central Valley (Gilbert 1895, Rich 1920, Healey 1980, Taylor 1990b). The LCR ESU consists mainly of ocean-type Chinook.

The diet of outmigrating ocean-type Chinook salmon varies geographically and seasonally, and feeding appears to be opportunistic (Healey 1991). Aquatic insect larvae and adults, *Daphnia*, amphipods (*Eogammarus* and *Corophium spp.*), and *Neomysis* have been identified as important food items (Kjelson et al 1982, Healey 1991). Rivers with well-developed estuaries are able to sustain larger ocean-type populations than those without (Levy and Northcote 1982). Juvenile Chinook salmon growth in estuaries is often superior to river-based growth (Rich 1920, Reimers 1971).

The loss of coastal wetlands to urban or agricultural development directly impacts ocean-type populations. Dahl (1990) reported that California has lost 94% of its wetlands. Furthermore, an estimated 80-90% of the undiked tidal marshlands in the Sacramento River Delta area, the major nursery area for Central Valley Chinook salmon stocks, has been lost (Nichols et al 1986, Lewis 1992). A similar reduction has been reported in Washington and Oregon wetlands: a 70% loss in the Puget Sound, 50% in Willapa Bay, and 85% in Coos Bay (Refalt 1985).

The most significant process in the juvenile life history of Chinook salmon is smoltification, the physiological and morphological transition from a freshwater to marine existence. The emigration from river to ocean is thought to have evolved as a consequence of differences in food resources and survival probabilities in the two environments (Gross 1987). Ocean-type juveniles enter saltwater during one of three distinct phases. "Immediate" fry migrate to the ocean soon after yolk resorption at 30-45 mm in length (Lister et al 1971, Healey 1991). In most river systems, however, fry migrants, which migrate at 60-150 days post-hatching, and fingerling migrants, which migrate in the late summer or autumn of their first year, represent the majority of ocean-type emigrants. When environmental conditions are not conducive to subyearling emigration, ocean-type Chinook salmon may remain in fresh water for their entire first year.

Ocean-type Chinook salmon tend to utilize estuaries and coastal areas more extensively for juvenile rearing. In general, the younger (smaller) the juveniles are at the time of entering the estuary, the longer they stay there (Kjelson et al 1982, Levy and Northcote 1982, Healey 1991). Brackish water areas in estuaries also moderate physiological stress during parr-smolt transition. The development of the ocean-type life-history strategy may have been a response to the limited carrying capacity of smaller stream systems and glacially scoured, unproductive watersheds, or a means of avoiding the impact of seasonal floods in the lower portion of many watersheds (Miller and Brannon 1982). Ocean-type Chinook salmon may also use seasonal flood cycles as a cue to volitionally begin downstream emigration (Healey 1991). Migratory behavior in ocean-type Chinook salmon juveniles is also positively correlated with water flow (Taylor 1990a).

Runs are designated on the basis of adult migration timing; however, distinct runs also differ in the degree of maturation at the time of river entry, thermal regime and flow characteristics of their spawning site, and actual time of spawning. Early, spring-run Chinook salmon tend to enter freshwater as immature or "bright" fish, migrate far upriver, and finally spawn in the late summer and early autumn. Late, fall-run Chinook salmon enter freshwater at an advanced stage of maturity, move rapidly to their spawning areas on the mainstem or lower tributaries of the rivers, and spawn within a few days or weeks of freshwater entry (Fulton 1970, Healey 1991). Summer-run fish show intermediate characteristics of spring and fall runs, spawning in large and medium-sized tributaries, and not showing the extensive delay in maturation exhibited by spring-run Chinook salmon (Fulton 1968).

All stocks, and especially those that migrate into freshwater well in advance of spawning, utilize resting pools. These pools provide an energetic refuge from river currents, a thermal refuge from high summer and autumn temperatures, and a refuge from potential predators (Berman and Quinn 1991, Hockersmith et al 1994). Furthermore, the utilization of resting pools may maximize the success of the spawning migration through decreases in metabolic rate and the potential reduction in susceptibility to pathogens (Bouck et al 1975, Berman and Quinn 1991).

Run timing is also, in part, a response to streamflow characteristics. Rivers such as the Klickitat or Willamette Rivers historically had waterfalls which blocked upstream migration except during high spring flows (WDFW 1993). Low river-flows on the south Oregon coast during the summer result in barrier sandbars which block migration (Kostow 1995). The timing of migration and, ultimately, spawning must also be cued to the local thermal regime. Egg deposition must be timed to ensure that fry emerge during the following spring at a time when the river or estuary productivity is sufficient for juvenile survival and growth.

Lower Columbia River ESU

The fall run is predominant in the Lower Columbia River ESU. Fall-run fish return to the river in mid-August and spawn within a few weeks (WDF et al 1993, Kostow 1995). These fall-run Chinook salmon are often called "tules" and are distinguished by their dark skin coloration and advanced state of maturation at the time of freshwater entry. Tule fall-run Chinook salmon populations may have historically spawned from the mouth of the Columbia River to the Klickitat River (RKm 290). Whatever spawning grounds were accessible to fall-run Chinook salmon on the Klickitat River (below Lyle Falls at RKm 3) would have been inundated following the construction of Bonneville Dam (RKm 243) in 1938 (Bryant 1994, Hymer et al 1992, WDF et al 1993). Tule fall-run Chinook salmon begin the freshwater phase of their return migration in late August and October and the peak-spawning interval does not occur until November (WDF et al 1993).

The majority of fall-run Chinook salmon transition to the marine environment as subyearlings (Reimers and Loeffel 1967, Howell et al 1985, Hymer et al 1992, Olsen et al 1994, WDF et al 1993). A portion of returning adults whose scales indicate a yearling smolt migration may be the result of extended hatchery-rearing programs rather than of natural, volitional yearling emigration. It is also possible that modifications in the river environment may have altered the duration of freshwater residence. Adults return to tributaries in the lower Columbia River at 3 and 4 years of age.

Chinook salmon in the Lower Columbia River ESU have been strongly affected by losses and alterations of freshwater habitats. Bottom et al (1985), WDF et al (1993), and Kostow (1995) provide reviews of habitat problems. Timber harvesting and associated road building occur throughout the region on Federal, State, and private lands. These activities increase sedimentation and debris flows and reduce cover and shade, resulting in aggradation, embedded spawning gravel, and increased water temperatures. Timber harvest in the Oregon portion of the region peaked in the 1930s, but habitat impacts remain (Kostow 1995). Agriculture is also widespread in the lower portions of river basins, and has resulted in widespread removal of riparian vegetation, rerouting of streams, degradation of streambanks, and summer water withdrawals. Urban development has had substantial impacts in the lower Willamette Valley, including channelization and diking of rivers, filling and draining of wetlands, removal of riparian vegetation, and pollution (Kostow 1995).

The Lower Columbia River ESU includes all native populations from the mouth of the Columbia River to the crest of the Cascade Range, excluding populations above Willamette Falls. Celilo Falls, which corresponds to the edge of the drier Columbia Basin Ecosystem and historically may have presented a migration barrier to Chinook salmon at certain times of the year, is the eastern boundary for this ESU. Not included in this ESU are "stream-type" spring-run Chinook salmon found in the Klickitat River (which are considered part of the Mid-Columbia River Spring-Run ESU) or the introduced Carson spring-Chinook salmon strain. "Tule" fall Chinook salmon in the Wind and Little White Salmon Rivers are included in this ESU, but not introduced "upriver bright" fall-Chinook salmon populations in the Wind, White Salmon, and Klickitat Rivers.

Upper Willamette ESU

This ESU includes native spring-run populations above Willamette Falls. Fall Chinook salmon above the Willamette Falls were introduced and are not considered part of this ESU. Populations in this ESU have an unusual life history that shares features of both the stream and ocean types. Intrabasin transfers have contributed to the homogenization of Willamette River spring-run Chinook salmon stocks; however, Willamette River spring-run Chinook salmon remain one of the most genetically distinctive groups of Chinook salmon in the Columbia River Basin. The geography and ecology of the Willamette Valley is considerably different from surrounding areas (see discussion of the Willamette Valley Ecoregion). Historically, the Willamette Falls offered a narrow temporal window for upriver migration, which may have promoted isolation from other Columbia River stocks.

Habitat blockage and degradation are significant problems in this ESU. Available habitat has been reduced by construction of dams in the Santiam, McKenzie, and Middle Fork Willamette River Basins, and these dams have probably adversely affected remaining production via thermal effects. Agricultural development and urbanization are the main causes of serious habitat degradation throughout the basin (Bottom et al 1985, Kostow 1995).

Project Site Information

Upper Willamette River spring Chinook begin entering the Columbia River during January. Peak densities occur in late March, with entries tapering off by mid-May. Spring Chinook migrate past the site, bound for upstream tributaries. Spawning takes place in early fall (NOAA 1999).

Fall Chinook begin entering the Columbia and Willamette River in late August and runs taper off by mid-October. Spawning typically occurs from mid-September to late October (Bennett and Foster 1991). Wild fry begin emigrating in late December. The migration of wild juveniles peaks the first week of June at Willamette Falls. Fall Chinook juveniles migrate to the Columbia River estuary as subyearlings (Howell et al 1985). Fall Chinook generally spend two to five years in the ocean before returning to spawn.

Knutsen and Ward (1991) study of the behavior of juvenile salmonids migrating through the Portland Harbor area found that subyearling Chinook salmon appeared to be actively migrating through the area. Even during periods of low river flow, they did not spend more than a few days in the harbor area. Information on the migratory behavior of subyearlings Chinook is limited. Subyearling Chinook were found in the harbor area over a longer period than other species or races of salmonids, probably because they actively fed during migration. There was little certainty to what extent they were actively migrating. Electrofishing catches from 1987 indicated that some juveniles might over-winter in the lower Willamette River (NOAA 1999).

5.1.2 Steelhead (*Oncorhynchus mykiss*) [2]

Steelhead exhibits the most complex suite of life history traits of any species of Pacific salmon. They can be anadromous or freshwater resident (and under some circumstances, apparently yield offspring of the opposite form). Resident forms are usually called rainbow- or redband trout. Those that are anadromous can spend up to 7 years in fresh water prior to smoltification, and then spend up to 3 years in salt water prior to first spawning. The life history type in southern Oregon and northern California spends only 2 to 4 months in salt water after smoltification, then returns to fresh water and outmigrates to sea again the following spring without spawning. Another life history variation is the ability of this species to spawn more than once (iteroparity),

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2 This information is summarized from Busby et al 1996.

whereas all other species of *Oncorhynchus*, except *O. clarki*, spawn once and then die (semelparity).

The most widespread run type of steelhead is the winter (ocean-maturing) steelhead. Winter steelhead occurs in essentially all coastal rivers of Washington, Oregon, and California, south to Malibu Creek. Summer (stream-maturing) steelhead, including spring and fall steelhead in southern Oregon and northern California, are less common.

Available information for natural populations of steelhead indicates considerable overlap in migration and spawn timing between populations of the same run type. Moreover, there is a high degree of overlap in spawn timing between populations regardless of run type. California steelhead generally spawn earlier than those in areas to the north; both summer and winter steelhead in California generally begin spawning in December, whereas most populations in Washington begin spawning in February or March. Relatively little information on spawn timing is available for Oregon and Idaho steelhead populations. Among inland steelhead, Columbia River populations from tributaries upstream of the Yakima River spawn later than most downstream populations.

Steelhead from British Columbia and Alaska most frequently smolt after 3 years in fresh water (Withler 1966, Narver 1970, Sanders 1985). In most other populations for which there are data, the modal smolt age is 2 years. Hatchery conditions usually allow steelhead to smolt in 1 year; biologists use this difference to distinguish hatchery and wild steelhead. North American steelhead commonly spend 2 years (*2-ocean*) in the ocean before entering fresh water to spawn. Populations in Oregon and California have higher frequencies of age-1-ocean steelhead than populations to the north, but age-2-ocean steelhead generally remains dominant.

For most steelhead populations, total age at maturity can be estimated by adding the smolt age and saltwater age. However, summer steelhead (especially in the Columbia River Basin) enter fresh water up to a year prior to spawning, and that year is generally not accounted for in the saltwater age designation; for example, a 2-ocean steelhead from the Yakima River may actually have 3 years between smolting and spawning.

Most steelhead in Alaska and British Columbia are 3/2 (smolt age/ocean age) and have a total age of 5 years at first spawning. For coastal steelhead in Washington, Oregon, and northern California, the modal total age at maturity is 4 years (2/2). Central and southern California steelhead appear to spend less time in the ocean, and they are dominated by 3-year-old (2/1) spawners.

As noted above, most species of salmon die after spawning, whereas steelhead may spawn more than once. The frequency of multiple spawning is variable both within and among populations. For North American steelhead populations north of Oregon, repeat spawning is relatively uncommon, and more than two spawning migrations is rare. In Oregon and California, the frequency of two spawning migrations is higher, but more than two spawning migrations is still unusual.

Lower Columbia River ESU

This coastal steelhead ESU occupies tributaries to the Columbia River between the Cowlitz and Wind Rivers in Washington and the Willamette and Hood Rivers in Oregon, inclusive. Excluded from the ESU are steelhead in the upper Willamette River Basin above Willamette Falls, and steelhead from the Little and Big White Salmon Rivers, Washington, which are in the Middle Columbia River ESU.

NFMS delineated this ESU primarily by genetics and habitat features. Steelhead populations in this ESU are of the coastal genetic group (Schreck et al 1986, Reisenbichler et al 1992, Chapman et al 1994), and a number of genetic studies have shown that they are part of a different ancestral lineage than inland steelhead from the Columbia River Basin. Genetic data also show steelhead from this ESU to be distinct from steelhead from the upper Willamette River and from coastal streams in Oregon and Washington. Recent genetic data from WDFW also show clear differences between samples from the Wind, Washougal, and Big White Salmon Rivers and those from the coast of southwest Washington.

This ESU is composed of winter steelhead and summer steelhead. Nonanadromous *O. mykiss* co-occur with the anadromous form in Lower Columbia River tributaries; however, the relationship between these forms in this geographic area is unclear. Life history attributes for steelhead within this ESU appear to be similar to those of other west coast steelhead.

Significant habitat blockages resulted from dams on the Sandy River, and minor blockages (such as impassable culverts) are likely throughout the region. Habitat problems for most stocks in this ESU are similar to those in adjacent coastal ESUs. Clearcut logging has been extensive throughout most watersheds in this area, and urbanization is a substantial concern in the Portland and Vancouver areas. Because of their limited distribution in upper tributaries, summer steelhead appear to be at more risk from habitat degradation than are winter steelhead. Hatchery fish are widespread and escape to spawn naturally throughout the region. The major present threat to genetic integrity for steelhead in this ESU comes from past and present hatchery practices.

Upper Willamette ESU

The native steelhead of this basin are late-migrating winter steelhead, entering fresh water primarily in March and April (Howell et al 1985), whereas most other populations of west coast winter steelhead enter fresh water beginning in November or December.

Substantial habitat blockages resulted from Detroit, Big Cliff and Green Peter Dams on the Santiam River, and flood control dams on the main stem Willamette. Other blockages such as smaller dams or impassable culverts are likely throughout the region. Habitat problems for most stocks in this ESU are similar to those in adjacent coastal ESUs. Clearcut logging has been common throughout most watersheds in this area, and there is extensive urbanization in the

Willamette Valley. Bottom et al (1985) identified specific factors affecting salmon habitat in various areas of Oregon, including streamflow and temperature problems, riparian habitat losses, and instream habitat problems. Within the Willamette Valley, they noted that temperatures and streamflows reach critical levels for salmonids in places where there are significant water withdrawals or removal of streamside vegetation, that loss of riparian vegetation results from agricultural practices and rural and urban development, that bank erosion is severe in several areas of the basin, and that splash dams, debris removal and stream channelization have caused long-term damage to salmonid habitats.

Project Site Information

The Willamette River winter steelhead run occurs during the late winter to spring, with adults migrating upstream from February through May. Spawning occurs from March through May. Juvenile steelhead appear to actively migrate through the Portland Harbor area, spending less time in the area than other juvenile salmonids (Knutsen and Ward 1991).

Summer steelhead begin entering the Willamette River starting in early March migrating to spawning grounds above Willamette Falls. Peak migrations occur from mid-May through June. Adult fish remain in the river through the fall and spawn during the winter months. The majority of returning adults spend two years in saltwater.

5.1.3 Columbia River Chum Salmon (*Oncorhynchus keta*)[3]

The species has the widest natural geographic and spawning distribution of any Pacific salmonid, primarily because its range extends farther along the shores of the Arctic Ocean than other salmonids (Groot and Margolis 1991). Chum salmon have been documented to spawn from Korea and the Japanese island of Honshu, east, around the rim of the North Pacific Ocean, to Monterey Bay in southern California.

Chum salmon may historically have been the most abundant of all salmonids: Neave (1961) estimated that prior to the 1940s, chum salmon contributed almost 50% of the total biomass of all salmonids in the Pacific Ocean. Chum salmon also grow to be among the larger of Pacific salmon, second only to Chinook salmon in adult size.

Chum salmon spend more of their life history in marine waters than other Pacific salmonids. Chum salmon, like pink salmon, usually spawn in coastal areas, and juveniles outmigrate to seawater almost immediately after emerging from the gravel that covers their redds (Salo 1991). This ocean-type migratory behavior contrasts with the stream-type behavior of some other species in the genus *Oncorhynchus* (e.g., coastal cutthroat trout, steelhead, coho salmon, and most types of Chinook and sockeye salmon), which usually migrate to sea at a larger size, after months or years of freshwater rearing. This means that survival and growth in juvenile chum salmon depend less on freshwater conditions (unlike stream-type salmonids which depend heavily on freshwater habitats) than on favorable estuarine conditions. Another behavioral

3 This information is summarized from Johnson et al 1997.

difference between chum salmon and species that rear extensively in freshwater is that chum salmon form schools, presumably to reduce predation (Pitcher 1986), especially if their movements are synchronized to swamp predators (Miller and Brannon 1982).

Historically, chum salmon were distributed throughout the coastal regions of western Canada and the United States, as far south as Monterey Bay, California. Presently, major spawning populations are found only as far south as Tillamook Bay on the northern Oregon coast. Small spawning populations of chum salmon are regularly found as far south as the lower Columbia River and Tillamook Bay. The hydrology and flow patterns of rivers draining into the lower Columbia River are similar to those of coastal rivers immediately north and south of the Columbia River, with a single peak in December or January and relatively low flows in summer and fall.

Chum salmon are believed to spawn primarily in the lower reaches of rivers because they usually show little persistence in surmounting river blockages and falls. However, in some systems, such as the Skagit River, Washington, chum salmon routinely migrate over long distances upstream (at least 170 km in the Skagit River). In the Columbia River Basin, there are reports that chum salmon may historically have spawned in the Umatilla and Walla Walla Rivers, more than 500 km from the sea (Nehlsen et al 1991). However, these fish would have had to pass Celilo Falls, a web of rapids and cascades, which presumably was passable by chum salmon only at high water flows.

Chum salmon are limited to tributaries below Bonneville Dam, with the majority of fish spawning on the Washington side of the Columbia River. Chum salmon have been reported in October in the Washougal, Lewis, Kalama, and Cowlitz Rivers in Washington and to the Sandy River in Oregon (Salo 1991). The Oregon Department of Fish and Wildlife (ODFW) cited 25 locations in that state where chum salmon spawn in the lower Columbia River, but run times for these fish are unavailable (Kostow 1995).

For chum salmon, quantitative estimates of historical abundance are generally lacking. At best, historical abundance can be inferred from fishery landings data. Fishery landings suggest that chum salmon abundance may be near historical levels in the Puget Sound area, but that natural populations south of the Columbia River (and possibly to the north) are at very low levels relative to historic abundance.

Alterations and loss of freshwater habitat for salmonids have been extensively documented in many regions, especially in urban areas or habitat associated with construction of large dams. In the last 25 years, a major issue in "stream restoration" has been the role that large woody debris (LWD) plays in creating and maintaining Pacific salmon spawning and rearing habitat. Descriptions of pre-development conditions of rivers in Washington and Oregon that had abundant salmonid populations suggest that even big rivers had large amounts of instream LWD, which not only completely blocked most rivers to navigation but also contributed significantly to trapping sediments and nutrients, impounding water, and creating many side channels and sloughs (Sedell and Frogatt 1984, Sedell and Luchessa 1982). Many streams consisted of a network of sloughs, islands, and beaver ponds with no main channel. For example, portions of the Willamette River reportedly flowed in five separate channels, and many coastal Oregon rivers were so filled with logjams and snags that early explorers could not ascend them. Large woody debris, snags, and instream vegetation similarly blocked most rivers in coastal Washington and Puget Sound.

Simenstad et al (1982) reported that historically some of the more adverse impacts on the estuarine and freshwater habitats used by chum salmon resulted from "stream improvements" in the 1800s and early 1900s, when logs were transported down streams and stored in main stems of rivers, lakes and estuaries. These activities included blocking off sloughs and swamps to keep logs in the mainstream and clearing boulders, trees, logs, and snags from the main channel. Smaller streams required the building of splash dams to provide sufficient water to carry logs. Scouring, widening, and unloading of main-channel gravel during the log drive may have caused as much damage as the initial stream cleaning.

Because of the well-known aversion of chum salmon to surmounting in-river obstacles to migration, the effects of the mainstem Columbia River hydropower system have probably been more severe for chum salmon than for other salmon species. Bonneville Dam presumably continues to impede recovery of upriver populations. Substantial habitat loss in the Columbia River estuary and associated areas presumably was an important factor in the decline and also represents a significant continuing risk for this ESU.

Project Site Information
There is no record of chum use of the area.

5.1.4 Lower Columbia River / Southwest Washington Coho Salmon (*Oncorhynchus kisutch*)[4]

Coho salmon is a widespread species of Pacific salmon, occurring in most major river basins around the Pacific Rim from central California to Korea and northern Hokkaido, Japan (Laufle et al 1986). Recently published investigations have reported that a number of local populations of coho salmon in Washington, Oregon, Idaho, and California have become extinct, and that the abundance of many others is depressed (e.g., Brown and Moyle 1991, Nehlsen et al 1991, Frissell 1993, Wilderness Society 1993). These declines have led several conservation groups to petition the National Marine Fisheries Service (NMFS) to list populations of coho salmon as threatened or endangered "species" under the U.S. Endangered Species Act.

On July 25, 1995, NMFS determined that listing was not warranted for this ESU. However, the ESU is designated as a candidate for listing due to concerns over specific risk factors. The ESU includes all naturally spawned populations of coho salmon from Columbia River tributaries below the Klickitat River on the Washington side and below the Deschutes River on the Oregon

4 This information is summarized from Johnson et al 1991 and Weitkamp et al 1995.

side (including the Willamette River as far upriver as Willamette Falls), as well as coastal drainages in southwest Washington between the Columbia River and Point Grenville. Major river basins containing spawning and rearing habitat for this ESU comprise approximately 10,418 square miles in Oregon and Washington.

Collection of life history information of coho is confounded by several factors. The first is natural variability in a species that is extremely widespread. Fish examined in different years or from different locations or habitats within a basin may display different life history characteristics. A second factor is lack of information on life history traits, especially the lack of long-term data sets, from most naturally spawning populations. Lastly, studies demonstrate that land-use practices (Hartman et al 1984, Holtby 1982) and artificial propagation (Steward and Bjornn 1990, Flagg et al 1995) may alter life history traits.

It is clear from the historic record that natural production of coho salmon is now substantially below historical levels, although this decline has been offset by hatchery production in many areas. Decline in the natural population is likely related to freshwater and estuarine habitats degradation. The ODFW conducts annual coho salmon spawning surveys in the lower Columbia River Basin (Fennell 1993). These surveys indicated that natural spawning of coho salmon in this region declined precipitously in the early 1970s and have remained at extremely low levels.

The Clackamas River, a tributary of the Willamette River, may support a native run of coho salmon that is a remnant run of fish native to the lower Columbia River Basin (Cramer and Cramer 1994). Cramer and Cramer concluded that production of the native population is depressed due to a variety of factors. They further concluded that under current harvest rates, the population is likely to remain stable but is vulnerable to over harvest. Johnson et al (1991) briefly reviewed abundance data for this population and, although they concluded that it had a low risk of extinction if population parameters remained stable, they recommended close monitoring of the population.

The Clackamas River produces moderate numbers of natural coho salmon. The Clackamas River late-run coho salmon population is relatively stable under present conditions, but depressed and vulnerable to over harvest. Its small geographic range and low abundance make it particularly vulnerable to environmental fluctuations and catastrophes, so this population may be at risk of extinction despite relatively stable spawning escapements in the recent past.

Project Site Information

Coho migrate up the Willamette from late August through early November with peak numbers beginning in mid- to late September. Spawning occurs from September through December and juveniles outmigrate the following spring.

5.1.5. Coastal Cutthroat Trout (*Oncorhynchus clarki clarki*)[5]

Coastal cutthroat trout are found in the coastal plains of western North America from southeastern Alaska to northern California (Trotter 1989). This species rarely overwinter in the sea and do not usually make extensive oceanic migrations. Unlike Pacific salmon, coastal cutthroat trout are iteroparous rather than semelparous and adults have been known to spawn each year for more than 6 years (Trotter 1989).

Interior and coastal cutthroat trout subspecies historically represented one of the most broadly distributed salmon species in western North America (Behnke 1979, 1992). The distribution of coastal cutthroat trout is broader, however, than any other subspecies. It extends along the Pacific coast from the Eel River in northern California (DeWitt 1954) to Prince William Sound in Alaska, extending out to the Kenai Peninsula (Scott and Crossman 1973, Behnke 1992). The eastern range of the subspecies rarely extends farther inland than 160 km and usually is less than 100 km. The eastern range appears to be bounded by the Cascade Mountain Range in California, Oregon, and Washington, and by the Coast Range in British Columbia and southeastern Alaska. This subspecies appears highly adapted to the coastal temperature areas such that even when fish have access to areas further inland (e.g., the Columbia River) they will move only a limited distance inland (Sumner 1972; Trotter 1987, 1989).

The life history of coastal cutthroat trout is very complex (Northcote 1997) with reproductive and migratory behaviors at least as diverse as those of steelhead and sockeye. Unlike many Pacific salmon where all or almost all members are anadromous, coastal cutthroat trout populations may contain both migratory and nonmigratory individuals within the same populations (Hall et al 1997). Not all members of the subspecies migrate to the sea, although all coastal cutthroat trout populations with access to the sea are believed to have an anadromous component (Giger 1972, Sumner 1972, Trotter 1989). Most cutthroat trout that do enter seawater do so as 2- or 3-year-olds, but some remain in fresh water for up to 5 years before entering the sea (Giger 1972, Sumner 1972).

Anadromous cutthroat trout spawning typically starts in December and continues through June, with peak spawning in February (Pauley et al 1989, Trotter 1989). Spawning occurs upstream of coho salmon and steelhead spawning zones, although some overlap may occur (Lowry 1965, Edie 1975, Johnston 1982). The coastal cutthroat trout spawning sites in small tributaries at the upper limit of spawn and rearing sites of coho salmon and steelhead appear to be an adaptation to reduce competition for suitable spawning sites and reduce competitive interactions between the young-of-the-year coastal cutthroat trout and other salmonids.

The southwestern Washington-Lower Columbia River region historically supported healthy coastal cutthroat trout populations. Coastal cutthroat trout, especially the freshwater forms, may still be well distributed in most river basins in this geographic region, probably in lower numbers relative to historical populations sizes. Severe habitat degradation throughout the Lower

5 This information is summarized from Johnson et al 1999.

Columbia River area has contributed to dramatic declines in anadromous cutthroat trout populations and two near extinctions of anadromous runs in the Hood and Sandy Rivers.

6. BASELINE CONDITIONS IN THE WILLAMETTE RIVER

This section describes habitat pathways and indicators important for salmonids in the riverine ecosystem. Riverine habitat is emphasized because of the potential effects of the proposed action on this type of habitat. For non-salmonid threatened and endangered species in the action area, EPA used a more narrative approach (See Section 18). The complexities of salmonid life histories and estuarine use warranted a more structured approach for the assessment of effects.

EPA based the following description of potential project effects on a set of ecological pathways that may affect listed salmonids by changes in their environment and within the action area. EPA considered the ecological pathways of water quality, habitat access, habitat elements, channel condition and dynamics, flow hydrology and watershed conditions and described existing baseline condition through a set of indicators of these ecological pathways. The indicators reflect essential features of designated critical habitat for Chinook salmon. Although critical habitat has not been designated for sea-run cutthroat and coho, many of these features may also be important for the conservation of these species. EPA assessed potential project-related changes to the existing baseline conditions using the indicators for each pathway. This allowed EPA to draw conclusions about potential impacts on listed salmonids and their critical habitat. The following is a list of indicators for each of the identified ecological pathways after NMFS (1999). EPA selected these indicators for assessment as they reflected that the action area is primarily a migration area for salmonids. No spawning occurs although there may be some rearing activity in more protected habitats.

Indicators of water quality:

- Temperature
- Sediment/Turbidity
- Water contamination
- Sediment contamination

Indicators of habitat access:

- Physical barriers

Indicators of habitat elements:

- Large woody debris
- Shallow water habitat

Indicators of channel conditions and dynamics:

- Streambank condition
- Floodplain connectivity

Indicators of watershed conditions:
- Disturbance history
- Riparian reserves

The pathways and indicators are described in the following.

6.1 Water Quality – Temperature

Temperatures can create serious problems for migrating adult salmon. In addition to posing the threat of direct lethality to adult spawners, temperatures can create blockages that stop migrating fish, create conditions that result in high mortality of spawners from disease, and reduce the overall fitness of migrants (WDOE 2001). Since adult migrating salmon do not feed in freshwaters they must enter freshwater with sufficient fat and muscle reserves to supply their metabolic requirements up to and through the act of spawning. The increased active and basal metabolic demands caused by traveling and holding in warmer waters uses up stored energy reserves at a more rapid rate. This can result in a decrease in the quality and quantity of eggs as well as an overall reduction in the fitness of the adult fish that need to migrate and negotiate obstacles, excavates and guard redds, and complete the act of spawning. Berman and Quinn (1991) demonstrated that in the months prior to spawning, spring run Chinook actively sought out cool water refuges in the Yakima River (Washington), which may have significantly reduced their metabolic demand.

Daily maximum temperatures rising above 70-72 degrees F are widely cited as causing barriers to migrating Chinook salmon (Stabler 1981, Bumgarner et al 1997, Hallock et al 1970). Gray (1990) suggested that incremental increases of 10-15 degrees formed a barrier to migration. Sauter and Maule (1997) reported cessation of feeding as well as thermoregulatory behavior in sub-yearling fall Chinook held between 64-72 degree F with exposure to 68 degrees for several hours inducing heat shock proteins (Sauter and Maule 1997). In a field study by Frissel et al (1992) it was found that maximum water temperatures in a coastal river system in Oregon were linked to the presence or absence of various species of salmonids. While it was noted that cutthroat were absent and coho salmon rare or absent in segments exceeding 70 degrees, Chinook dropped out completely only at 73 degrees, although their presences in such waters was associated with positioning in small cool pockets in otherwise warm reaches.

Piper et al (1982) suggested that 45 to 60 degrees F was necessary to protect upstream migration and maturation. Bell (1958) stated that temperatures should be within the range of 38 to 56 degrees for spring Chinook, 57 to 68 degrees for summer Chinook, and 51 to 67 degrees for fall Chinook. Support for assuming a general 68 to 70 degrees threshold can also be found in the literature on lethality studies. Temperatures of 68 to 72 can be directly lethal to Chinook salmon (Brett 1956, Brett et al 1982, Coutant 1970,) with a seven-day exposure. It also appears from the available evidence that adults may be more sensitive than the juveniles (Becker 1973).

In a review by the Washington State Department of Ecology, they recommended that suitable conditions for migration period should be maintained below 68 to 70 degrees F. For salmon that may hold in an area throughout the summer, they recommend a 21-day average water temperature be maintained below 55 to 57 with the 7-day average of the daily maximum temperatures below 60 to 63.

Baseline Condition. The Oregon State Department of Environmental Quality (DEQ) lists the lower portion of the Willamette River on their 303(d) for impaired waterways as exceeding summer maximum temperatures. The criteria listed for protectiveness is salmonid rearing with a maximum of 68 degree F. While it is not clear for how long this situation continues during the summer months, it is clear that periodic high water temperatures may act as either a migration barrier or at least a source of stress for migrating fish. This condition is very different from historic conditions where the system of braided channels within the riparian gallery forest likely maintained lower summer water temperatures during critical migration periods. The historic changes to the river (removal of riparian forests and channelization) have resulted in periodic high temperature conditions throughout the summer months. While salmon are able to migrate through the action area, high water temperatures during migration have likely resulted in additional stress and/or migration blockages. As such, the indicator is likely **at risk** at the site.

6.2 Water Quality – Sediment/Turbidity

Studies suggest that both wild and hatchery fish exhibit avoidance behavior in response to increases in turbidity. In laboratory tests, Martin et al (1977) found that juvenile chum exhibited avoidance behavior in all test concentrations, and that toxicity was primarily a function of suspended sediment composition (particle size and shape) and fish condition. Healthy fish were able to tolerate very high concentrations (up to 3056 mg/L), while fish infected by vibriosis and/or furunculosis (had) a very low tolerance to suspended sediment.

Adverse effects may occur when juvenile salmonids are unable to avoid high, extended periods of turbidity. Lethal suspended sediment concentrations occur at 1100 mg/L for Chinook salmon (Beauchamp et al 1983). Turbidity can also play a role in both salmon migration and feeding behavior. Adult salmon cease upstream movement in streams when total suspended solids (TSS) exceed 4000 mg/L (Healey 1991, Beauchamp et al 1983). Laboratory studies with juvenile coho salmon found that feeding stops when TSS concentrations reach 300 mg/L (Sandercock 1991). This level was the lowest value for turbidity that was reported to cause adverse effects. Preferred TSS levels for coho in streams are reported to be less than 25 mg/L (Laufle et al 1986).

While it is clear that juvenile fish will exhibit avoidance behavior in high turbidity levels, toxic effects also might occur when fish are unable to avoid high turbidity and if the turbid conditions occur over an extended period of time. Adverse effects from high turbidity are also more likely when juvenile salmon have been subjected to repeated environmental stresses that weaken their overall health and viability.

In summary, juvenile salmonids subjected to periodic fluctuations in turbidity are likely to either avoid or tolerate short-term conditions. However, long-term high turbidity events (either from catastrophic occurrences or anthropogenic disruptions of natural fluvial processes) may result in harm to juvenile salmon, especially if the fish have been stressed either through disease or other environmental stresses.

Baseline Condition. The Willamette River experiences periodic high turbidity during flood events. The salmon populations using the Willamette have evolved under the influence of the seasonal periods of high turbidity, especially during the spring thaw.

Although the Willamette River may have had high turbidity levels, the channelization of the lower Willamette River has changed the character of how sediment interacts in the system. There is no longer an expansive system of braided channels and flood plains to trap and transport sediment throughout the area. Most of the sediment is now discharged directly into the Columbia. Sediment plumes are likely of longer duration and higher turbidity than during historic conditions. The Willamette and Columbia Rivers have been heavily modified from natural conditions, which have resulted in a significant loss of support habitat for juvenile fish. Many years of industrial development have also increased the number of environmental stresses on migrating fish (degraded sediment and water quality).

Although the turbidity characteristics of the Willamette have changed from pre-settlement conditions, salmon species using the area have adapted to periodic fluxes of high turbidity. As such, the indicator is likely **properly functioning** at the site.

6.3 Water Quality - Water Contamination

The State of Oregon has established water quality criteria (WQC) for the protection of aquatic life. For the purposes of this BA, EPA has adopted these WQC for determining the presence of chemical contamination.

Baseline Condition. The Willamette River in the project area has five exceedances on the 303(d) list (impaired waters) for water quality. One is directly related to sediment bound contaminants at the project site. Indicators of quality of the water column have exceedances for summer high temperature and fecal-coliform (bacterial) contamination. There area also exceedances for mercury contamination of fish tissue and for fish skeletal deformities. All but the sediment bound contaminants relate to the entire lower Willamette and not just the project site.

The indicator at this site is **not properly functioning** because of the multiple listings on the 303(d) list that indicate system-wide contamination in the action area.

6.4 Water Quality - Sediment Contamination

Urban water bodies often receive inputs of potentially toxic substances from a variety of anthropogenic sources and many of these substances accumulate in sediment. Because juvenile salmon undergo numerous physiological adaptations during their migration, direct or indirect exposure to sediment contamination may be injurious. The level of biological dysfunction of a population of salmon has not been directly linked to a specific level of sediment contamination

(Varanasi et al 1993). However, Collier et al (1997) showed that contaminant concentrations found in chum and Chinook juveniles in the Hylebos Waterway were similar to those measured in juvenile salmon from the Duwamish River, another contaminated water body (Varanasi et al 1993; Arkoosh et al 1991; Arkoosh et al 1996). The Duwamish River study found impaired growth, suppression of immune function, and increased mortality following pathogen exposure in Chinook salmon. EPA interprets this information as evidence that juvenile fish may experience harm from high levels of chemical contamination in urbanized river systems.

Baseline Conditions. EPA's 1996 ROD (issued in conjunction with DEQ) described areas of the project site that were affected by chemical contaminants at high concentrations exceeding those found in Willamette River reference areas.

The high degree of sediment contamination currently found in the lower Willamette River is a product of very recent history, to which local fish populations have probably not adapted. There are probably some background conditions of naturally occurring contaminants, however, most of the chemical pollutants can be traced back to historic sources. At such, this indicator is **not properly functioning** in the action area.

6.5 Physical Barriers

The principle negative impact of physical barriers is the blockage of migration to upstream spawning areas (Li et al 1987).

Baseline Conditions. Approximately 400 miles of previously important spawning and rearing areas on the Willamette are no longer accessible (Foster 1991), which have seriously affected anadromous fish populations. The blocked passages range from major dams on the tributaries to the Willamette to undersized culverts on minor tributaries. Anadromous fish are still able to reach spawning areas along the Willamette, although the extent of area once available is seriously diminished. Within the action area, the Willamette main channel has no major blockages; however, access to any tributary channels or creeks was lost due to extensive development. This indicator is **at risk** in the action area.

6.6 Large Woody Debris

There has been extensive research regarding the importance of large woody debris within the riverine ecosystem for salmonids. LWD can provide refugia for outmigrating fish, it provides structure within the river to trap sediments, create pools and riffles, and serves as a source of organic detritus (food web support) (Everest and Sedell 1983).

Baseline Conditions. The extensive channelization of the Willamette River has reduced river meanders, braided channels, and limited access to the once broad flood plain, which drastically reduced the ability of LWD to reach the river systems. With the removal of many of the riparian gallery forests, LWD was even more severely restricted. On the tributaries, logging practices regularly removed sources of LWD and even cleaned channels of debris so that they could be used as transportation corridors for timber. There is very little source of LWD at the action area and limited area and/or opportunity for it to collect as a habitat feature. This indicator is **not properly functioning** in the action area.

6.7 Shallow Water Habitat

Juvenile salmon seek refuge from large in-water predators in shallow water areas, preferably back- and side-channels. These areas can provide relatively safe feeding and/or resting habitat. In the absence of back and side channels, shallow water along shorelines is important for providing refugia. Smaller juveniles are usually found at shallower depths with larger fish gradually migrating to deeper water. Out-migrating fish also prefer low banks and low slope areas because they are usually associated with increased benthic and terrestrial prey abundance (Anchor Environmental et al 1999).

Baseline Conditions. The extensive channelization of the main stem of the Willamette River has resulted in a simplified ecosystem and the loss of much of the original fish habitat (Altman et al 1997). Sedell and Frogatt (1984) report than in 1854 the 15.6-mile distance between Harrisburg and the McKenzie River had over 156 miles of shoreline; today there is less than 40. In the action area, most of the remaining offchannel/refugia habitat has been so severely degraded that little of its original character and quality remain. Shallow nearshore areas now play much of the role that back channels played prior to development, although these areas are typically small and discontinuous. Existing shallow water nearshore habitats have become important support habitat for migrating salmonids, although their ability to support sustainable populations is questionable (Altman et al 1997). This indicator is **at risk** in the action area.

6.8 Streambank Condition

Armoring or hardening of the natural shorelines reduces available feeding habitat and increases predation on juvenile salmonids by reducing or eliminating shallow water refugia. Shoreline hardening also restricts or removes natural riparian and wetland vegetation and changes natural sedimentation and erosion patterns.

Baseline Conditions. The most extensive urbanization of the Willamette River has occurred in the action area (metropolitan Portland), although urbanization has occurred along most of the major tributaries and the mainstem of the Willamette. Natural shorelines and nearshore habitat have been substantially altered by the construction of wharfs, piers, and riprap shorelines (Altman et al 1997). There is very little natural shoreline or riparian vegetation anywhere within the action area. What remains is isolated and surrounded by urban development. This indicator is **not properly functioning** for the action area.

6.9 Floodplain Connectivity

In a naturally functioning riverine system, the flood plain features serve to dissipate flood energies during high flows and augment river system during low flows. Flooded areas adjacent to rivers and streams also provided refugia and feeding habitats for juvenile salmonids. Flood plains were also an important source of organic detritus for the riverine food web.

Baseline Conditions. The Willamette River has a long history of flood control efforts ranging from the construction of many flood control projects on the tributaries to channelization in the urbanized areas (Altman et al 1997). All of these efforts served to dramatically reduce the extent of the floodplain and its interaction with the river. Very little connectively remains today, especially in the heavily urbanized action area. This indicator is **not properly functioning** in the action area.

6.10 Disturbance History

The Willamette River is the 13th largest river in the United States and covers an area of approximately 12,000 square miles. The Willamette Basin is 70 percent forested, 22 percent agricultural, and 5 percent urbanized (Bonn et al 1995). Approximately 70 percent of Oregon's population lives within the basin (DEQ 1988). The Willamette basin has been significantly altered since before European settlement, which has resulted in significant changes to the health and function of the watershed. Most significant to aquatic resources have been logging and farming, urban development, channelization of the river, and the construction of major dams on the tributaries. The lands surrounding the Willamette River itself have been the most highly disturbed. Patterns of disturbance are likely to continue.

Baseline Conditions. The action area is one of the most heavily disturbed areas of the Willamette River. Perturbations to the area from industrial use and development, navigational dredging, and non-point sources of pollution are likely to continue. This indicator is **not properly functioning** for the action area.

6.11 Riparian Reserves

The distribution and quality of riparian habitat in the Willamette basin is highly variable as a result of the diversity of environmental factors (topography, geomorphology, soils, climate, vegetation) and human related factors (habitat perturbations and land use) that exist within the surrounding landscape (Altman et al 1997). The most extensive loss or alternation of riparian habitats, however, have occurred around the mainstem and are associated with urban and agricultural development along the broad flood plains. Almost all of the once extensive gallery forests have been lost or isolated from interaction with the river. Remnant patches remain scattered throughout the valley (Altman et al 1997).

Baseline Conditions. The lower Willamette River (including the action area) has lost most of its riparian forests due to development and/or channel alteration. This indicator is **not properly functioning** for the action area.

7. EFFECTS OF THE ACTION

This section provides EPA's analysis of the direct and indirect effects of the proposed action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent to the action. These effects are considered along with the environmental baseline and the predicted cumulative effects to determine the overall effects to the species [50 CFR §402.02]. The separate elements include the following:

- Removal of existing piling near ordinary high water (OHW) on the south side of the existing bulkhead.
- Displacement of existing shoreline woody debris near the OHW to facilitate installation of the wall
- Construction of a perimeter sheet-pile wall along approximately 1170 linear feet of the Willamette shoreline above OHW. Total sheet pile wall length at the project site will be approximately 1270 feet.
- Construction of 2380 feet of slurry wall encompassing upland portions of the property. The sheet pile and slurry walls will connect at the north and south upland 'wings' of the sheet pile wall.

EPA determined the effects on the listed, proposed and candidate species by predicting changes in baseline condition for each of the indicators. The EPA's analysis is discussed in the following sections.

8. WATER QUALITY HABITAT INDICATORS

8.1 Temperature

Effects of Removal of Existing Piling. The existing piles will all be cut at the ground surface and removed to a suitable disposal site. The proposed schedule for removal is during January of 2003, which may coincide with high water events. If possible, removal will be restricted to times when the beach is exposed. However, even if the pilings are removed during high water events, there will likely be no changes to water temperature as a result of these activities.

Effects of Displacement of Existing Shoreline Woody Debris. The displacement of the shoreline debris will occur at the same time as the removal of the piling and under the same conditions. There will be no changes to water temperature as a result of these activities.

Construction of a Perimeter Sheet Pile Wall. Construction of the sheet pile wall will begin in January 2003. Construction will be limited to the upland side of the shoreline and will not occur during any flooding or high water events. There will be no changes to water temperature as a result of these activities.

Construction of an Upland Slurry Wall. All construction activities associated with this project will be limited to the upland. There will be no changes to water temperature as a result of these activities.

Effect on Baseline. EPA determined that the action would maintain the baseline conditions for water temperature in the action area for the following reasons:

- The actions will have limited, if any, contact with surface water.
- The actions will occur at a time of the year when high water temperatures are not expected.

8.2 Sedimentation/Turbidity

Effects of Removal of Existing Piling. After pile removal, there may be some surface instability at the removal site because of disturbances associated with removal (digging, cutting). The first event of water coming in contact with the removal area may result in a brief increase in turbidity. However, any high water event that would reach the removal site would likely be carrying such a high sediment load that any increases from the project site would be negligible. If necessary, a silt fence could also be installed during removal to limit any potential for increased surface water turbidity. Any changes in turbidity associated with this action will be temporary in nature and limited in extent.

Effects of Displacement of Existing Shoreline Woody Debris. There will be the same potential changes in turbidity as associated with the piling removal (noted above).

Construction of a Perimeter Sheet Pile Wall. Construction of the sheet pile wall, which includes staging of the construction equipment, may increase turbidity at the site by disturbing the existing shoreline surface. The disturbance may result in increased discharge of sediments during the first high water periods after construction (or during construction). However, as noted above, any high water event that would reach the construction area is likely to be carrying a high sediment load with increased turbidity levels. EPA will also have site controls in place that limit potential turbidity increases at the project site, which would include runoff controls from construction stormwater. As such, any changes in turbidity associated with the action will be temporary in nature and limited in extent.

Construction of an Upland Slurry Wall. All construction activities associated with this project will be limited to the upland. There will be no changes to water turbidity as a result of these activities.

Effect on Baseline. EPA determined that the action would maintain the baseline conditions for water turbidity in the action area for the following reasons:

- Any potential increases in turbidity would occur at high water events, which would be at a time when high turbidity conditions already occur. Any additional increase to turbidity from this project would be limited in extent and duration and would be negligible in comparison with seasonal background levels.
- EPA will have active controls to limit construction stormwater runoff from the project site.

8.3 Water Contamination

Effects of Removal of Existing Piling. Removal of the piles will occur in an area known to have surface contamination of sediments. Any sediment that may be disturbed during removal could result in additional water contamination. EPA will try to remove pilings in the dry (at lower river stages when the beach is exposed) when possible. If there are higher river stages during removal that would force in-water removal, then EPA will carefully control potential increases in turbidity through sediment fences or turbidity controlling methods (containment booms, silt curtains, etc). The pilings will be contained during removal and disposed in a suitable disposal site. With these protective removal measures, there will be no changes to water contamination as a result of this activity.

Effects of Displacement of Existing Shoreline Woody Debris. The same site conditions occur in the areas where woody debris will be moved. EPA will exercise the same care with woody debris displacement, especially with any partially buried debris. As such, there will be no changes to water contamination as a result of these activities.

Construction of a Perimeter Sheet Pile Wall. The sheet pile wall is containing an area that contains mobile NAPL that frequently discharges to the Willamette River. Construction of the sheet pile wall may result in additional surface discharges during construction. If these were to occur, it likely would be directly adjacent to the sheet pile alignment. The possible occurrence of additional releases instigated control requirements that would limit the area of release to the point of release. These controls include: (1) daily construction monitoring and documentation by an environmental professional; (2) the placement and maintenance of absorbent booms during construction of the sheet pile wall to contain potential releases; and (3) a containment plan should NAPL sheens be observed outside of the absorbent booms. These controls will assure that additional water contamination is not likely.

In the long-term, the intent of this action is to control the release of contaminants from the project site. The sheet pile and slurry walls will remove a current and on-going source of water contamination and will ultimately result in significantly decreased levels of water contamination.

Construction of an Upland Slurry Wall. All construction activities associated with this project will be limited to the upland. There will be no changes to water contamination as a result of these activities.

Effect on Baseline. EPA determined that the action would maintain and restore the baseline condition for water contamination in the action area for the following reasons:

- Contractor standards will require that measures be taken to prevent or minimize the potential for additional contaminant release caused by construction.
- The sheet pile and slurry walls are intended to eliminate an on-going source of surface water and sediment contamination.

8.4 Sediment Contamination

Effects of Removal of Existing Piling. Removal of the piles will occur in an area known to have surface contamination of sediments. Removal activities discussed above for water contamination also will prevent the contamination of sediments. There will be no changes to sediment contamination as a result of these activities.

Effects of Displacement of Existing Shoreline Woody Debris. The same site conditions occur in the areas where woody debris will be moved. As such, there will be no changes to sediment contamination as a result of these activities.

Construction of a Perimeter Sheet Pile Wall. See comments on water contamination (above). EPA believes that additional sediment contamination is unlikely.

In the long-term, the intent of this action is to prevent discharge of NAPL into sediments. As such, the sheet pile wall will remove a current and on-going source of water and sediment contamination.

Construction of an Upland Slurry Wall. All construction activities associated with this project will be limited to the upland. There will be no changes to sediment contamination as a result of these activities.

Effect on Baseline. EPA determined that the action would maintain the baseline sediment contamination in the action area for the following reasons:

- EPA would implement a rigorous control program for any potential releases during construction.
- The actions will contain an existing source of water contamination.

9. HABITAT ACCESS INDICATORS

9.1 Physical Barriers

Effects of Removal of Existing Piling. Removal of the piles would remove a shoreline migration barrier; although it is located high along the exposed beach shoreline (+8 and above OHW) and likely only acts as a barrier during high flows. As such, there will be no changes to physical barriers as a result of these activities.

Effects of Displacement of Existing Shoreline Woody Debris. The same site conditions occur in the areas where woody debris will be moved. As such, there will be no changes to physical barriers as a result of these activities.

Construction of a Perimeter Sheet Pile Wall. The alignment of the sheet pile wall is above OHW. As such, this action will have limited encroachment on potential migration pathways during high water conditions. Construction will be limited to 'dry' conditions and all construction materials will be removed from the shoreline in the event of any episodic high water conditions that may occur during the construction period. As such, EPA believes that the sheet pile wall and the construction of the sheet pile wall will create no physical barriers to fish passage and migration.

Construction of an Upland Slurry Wall. All construction activities associated with this project will be limited to the upland. There will be no changes to physical barriers as a result of these activities.

Effect on Baseline. EPA determined that the action would maintain the baseline condition for physical barriers in the action area for the following reasons:

- The alignment of the sheet pile wall is limited to the most elevated (highest) portions of the exposed shoreline.
- The construction activities will be done in the dry and will not act as a barrier.

10. HABITAT ELEMENTS INDICATORS

10.1 Large Woody Debris

Effects of Removal of Existing Piling. The existing piling is creosote treated wood and serves no habitat function as large woody debris. There will be no changes to large woody debris as a result of this activity.

Effects of Displacement of Existing Shoreline Woody Debris. Driftwood and other debris can collect in fairly significant amounts along the higher elevations of the shoreline and likely provide some function during high flows. Moving of this material to similar locations along the shoreline would not take large woody debris out of the riverine ecosystem. There will be no significant changes to amount and availability of large woody debris as a result of this activity.

Construction of a Perimeter Sheet Pile Wall. The sheet pile will remove some riparian vegetation from the shoreline during construction along the north section of the wall where it ties into the upland area. There are some large trees as well as understory vegetation that will be removed to facilitate construction. Care will be taken to limit vegetation removal although the specific area of loss will not be known until construction details are further developed. This area may be a source of large woody debris to the Willamette River. The construction will not remove all the large trees and these trees will continue to be available as potential riparian sources of large woody debris in the future.

Construction of an Upland Slurry Wall. All construction activities associated with this project will be limited to the upland. There will be no changes to large woody debris as a result of these activities.

Effect on Baseline. EPA determined that these actions would maintain the baseline condition for large woody debris in the action area because the amount and characteristics of large woody debris at the project site will not be substantially altered, although there will be some reduction in the volume of potential material due to removal of vegetation for construction. However, river processes continue to deliver additional woody debris to the shoreline.

10.2 Shallow Water Habitat

Effects of Removal of Existing Piling. The existing piling may provide additional limited refugia (increased complexity) within the existing shallow water habitat during high flows, which would be lost after removal. However, the availability of this current feature is limited to extreme high water events. The pilings are also creosote treated and located in a highly contaminated portion of the project site, which would decrease their value as adding complexity to the shallow water habitat. Removal of the piles will also not alter the slope or area of existing shallow water habitat.

Effects of Displacement of Existing Shoreline Woody Debris. The large woody debris currently along the shoreline likely provides some shallow water habitat complexity. Although much of this debris moves in and out of the area with regularity, it still provides important complexity in this habitat-limited section of the Willamette River. No large woody debris will be removed from the existing shoreline, and it is expected that additional woody debris will accumulate with normal river functions

Construction of a Perimeter Sheet Pile Wall. The sheet pile wall will result in short-term loss of some gently sloping shoreline areas during construction (south of the existing bulkhead). This area likely provides shallow water habitat during periods of high flow. However, the sheet pile wall will be constructed in the dry and is limited to areas that are available as habitat in only high water periods. Any adverse impacts to shallow water habitat associated with this activity will be short-term in extent and limited in nature.

Construction of an Upland Slurry Wall. All construction activities associated with this project will be limited to the upland. There will be no changes to shallow water habitat as a result of these activities.

Effect on Baseline. EPA determined that the action would maintain the baseline condition for shallow water habitat in the action area because no woody debris would be removed from the project area and additional woody debris will likely accumulate over time.

11. CHANNEL CONDITIONS AND DYNAMICS INDICATORS

11.1 Streambank Condition

Effects of Removal of Existing Piling. Removal of the existing piling will not change the characteristic of the existing stream bank or shoreline.

Effects of Displacement of Existing Shoreline Woody Debris. Moving of the shoreline woody debris would not alter the exiting stream bank.

Construction of a Perimeter Sheet Pile Wall. Construction of the sheet pile wall will be from the upland and will not alter or invade the existing stream bank. It will remain intact throughout construction.

Construction of an Upland Slurry Wall. All construction activities associated with this project will be limited to the upland. There will be no changes to stream bank conditions as a result of these activities.

Effect on Baseline. EPA determined that the action would maintain the baseline condition for streambank conditions in the action area because there would be no functional change to the existing stream bank.

11.2 Floodplain Connectivity

Effects of Removal of Existing Piling. This activity will have no effect on floodplain connectivity.

Effects of Displacement of Existing Shoreline Woody Debris. This activity will have no effect on floodplain connectivity.

Construction of a Perimeter Sheet Pile Wall. This activity will have no effect on floodplain connectivity.

Construction of an Upland Slurry Wall. This activity will have no effect on floodplain connectivity.

Effect on Baseline. EPA determined that the action would maintain the baseline condition for flood plain activity in the action area because it would have no effect on existing conditions.

12. CHANNEL CONDITIONS AND DYNAMICS INDICATORS

12.1 Disturbance History

Effects of Removal of Existing Piling. Removal of the existing pilings will not change the existing characteristics of the project site or the action area.

Effects of Displacement of Existing Shoreline Woody Debris. Moving of shoreline debris will not change the existing character of the project site or the action area.

Construction of a Perimeter Sheet Pile Wall. Construction of the sheet pile would temporarily alter the existing characteristics of the shorelines during construction, which would result in a temporary increase to disturbance activities along the shoreline. This impact would be short in duration and limited in nature. The existing characteristics of the shoreline may be restored upon completion of all of the remedial actions at this site, however this will be dependent upon any site controls that are necessary to reduce potential exposure to environmental receptors, including people. The current plans for the Willamette River sediment cap include restoration of the riverbank.

Construction of an Upland Slurry Wall. All construction activities associated with this project will be limited to the upland. There will be no changes to disturbance history as a result of these activities.

Effect on Baseline. EPA determined that the action would result in the maintenance of the baseline condition for disturbance history in the action area because construction would temporarily alter the existing characteristics of the shoreline. Impacts would be short in duration and limited in extent.

12.2 Riparian Reserves

Effects of Removal of Existing Piling. Removal of the existing pilings would have no effect on the riparian reserves of the action area.

Effects of Displacement of Existing Shoreline Woody Debris. Moving of the woody debris would have no effect on the riparian reserves of the action area.

Construction of a Perimeter Sheet Pile Wall. Construction of the sheet pile wall would remove vegetation from an existing riparian area. This would occur along the north section of the sheet pile alignment. Removal of vegetation will be carefully restricted to only those areas necessary to facilitate construction of the sheet pile wall. This work will result in a change to the complexity of the existing riparian habitat at the site because some vegetation will have to be cleared. EPA will direct the contractor to limit removal of large trees to the maximum extent practicable. The site will likely recolonize with riparian species because of the available seed sources located both on-site and immediately adjacent to the site (to the north).

Construction of an Upland Slurry Wall. All construction activities associated with this project will be limited to the upland. There will be no changes to stream bank conditions as a result of these activities.

Effect on Baseline. EPA determined that the actions will maintain the baseline condition for riparian reserves in the action area because limited area will be disturbed and existing riparian reserves are located immediately adjacent (north) of the site.

Table 2 provides a summary of all the indicators and expected changes in conditions as a result of the project.

Table 2
Expected Changes to Baseline Conditions

INDICATOR		**EFFECTS**		
	Restore	**Maintain**	**Degrade Short Term**	**Degrade Long Term**
WATER QUALITY				
Temperature		X		
Sediment/Turbidity		X		
Water Contamination	x			
Sediment Contamination	x			
HABITAT ACCESS				
Physical Barriers		X		
HABITAT ELEMENTS				
LWD		X		
Off Channel Refugia		X		
CHANNEL CONDITIONS AND DYNAMICS				
Streambank Condition		X		
Floodplain Connectivity		X		
WATERSHED CONDITIONS				
Disturbance History		X		
Riparian Reserves		X		

13. BENEFICIAL EFFECTS

EPA, through its responsibilities under CERCLA, has concluded that sediments at McCormick and Baxter are contaminated with hazardous substances. EPA also concluded that if the remedial actions specified in the ROD are not undertaken, the actual or threatened releases of hazardous substances may present an imminent and substantial endangerment to human health and/or the environment. As such, EPA is required to pursue actions that will control the release of hazardous substances.

There will be significant beneficial effects as a result of this action. Specifically, this action will contain mobile NAPL, which is a significant source of water and sediment contamination. This will also significantly reduce the exposure of fish and wildlife to hazardous substances and will assist in the improvement of sediment and water quality on the Willamette River by isolating contaminated materials. These actions will reverse the trend of continued degradation of the riverine environment.

14. INTERRELATED AND INTERDEPENDENT EFFECTS

Interdependent actions are those that have no independent utility apart from the action being considered. Interrelated actions are activities that are part of the larger action and depend on the larger action for their justification. As mentioned previously, a sediment cap is part of the remedy for contaminated Willamette River sediment. The cap cannot be constructed without containment of NAPL first occurring at the site by the installation of the subsurface barrier wall. However, the barrier wall must be built regardless of the final remedy for the Willamette River sediments. A separate biological assessment will be prepared once the design and implementation details have been substantially completed for the contaminated sediment remedy.

15. CUMULATIVE EFFECTS

Cumulative effects are defined in 50 CFR part 402.02 as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation." The action area for this project encompasses a significant portion of the Willamette River. This area is currently a disturbed riverine ecosystem altered by previous dredging, backfilling, sewage and industrial discharges, and other anthropogenic activities over the past 100 years. Future Federal actions including additional clean-up activities, navigational dredging, and activities permitted under Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbors Act will be reviewed under separate Section 7 consultation processes and are not considered cumulative effects.

The clean-up activities have potential to increase public interest in the site for educational purposes, recreational activities, or other shoreline amenities. Activities requiring Federal permits or Federal funding will be subject to Section 7 review.

16. CONCLUSION

The action area has degraded baseline conditions. The proposed action will contain a source of water and sediment contamination thereby resulting in improved baseline conditions. Therefore, EPA concludes that the proposed action will not jeopardize the continued existence of listed salmonid species, the proposed species, or the candidate species. Although the actions will either maintain or improve baseline habitat conditions, EPA concludes that there may be some potential for contaminant release during construction, which may result in direct harm to the listed, proposed, and candidate fish species. EPA believes that the probability of a release is low, however, measures will be in place during construction to control and minimize the impacts of should a release occur.

16.1 Chinook Salmon (Lower Columbia River ESU, Upper Willamette River ESU)

Containment of the source of sediment and river contamination (NAPL) is the primary purpose of the barrier wall and eventually the sediment cap. Thus, in the long-term, the remedial action will address unacceptable risks to the environment and public health, and reduce the levels of contamination in sediment. The project's long-term effects will help improve and restore salmon habitat in the Willamette River.

Of the 11 salmonid indicators, the project would result in maintaining or improving baseline conditions. EPA acknowledges, however, that there may be some impacts to Chinook salmon due the potential to release contaminants during construction. It is EPA's determination that project construction **may adversely affect Chinook salmon.**

16.2 Steelhead (Lower Columbia River ESU, Upper Willamette River ESU)

Containment of the source of sediment and river contamination (NAPL) is the primary purpose of the barrier wall and eventually the sediment cap. Thus, in the long-term, the remedial action will address unacceptable risks to the environment and public health, and reduce the levels of contamination in sediment. The project's long-term effects will help improve and restore salmon habitat in the Willamette River.

Of the 11 salmonid indicators, the project would result in maintaining or improving baseline conditions. EPA acknowledges, however, that there may be some impacts to steelhead salmon due the potential to release contaminants during construction. It is EPA's determination that project construction **may adversely affect steelhead salmon.**

16.3 Columbia Chum Salmon

Containment of the source of sediment and river contamination (NAPL) is the primary purpose of the barrier wall and eventually the sediment cap. Thus, in the long-term, the remedial action will address unacceptable risks to the environment and public health, and reduce the levels of contamination in sediment. The project's long-term effects will help improve and restore salmon habitat in the Willamette River.

Of the 11 salmonid indicators, the project would result in maintaining or improving baseline conditions. EPA acknowledges, however, that there may be some impacts to chum salmon due the potential to release contaminants during construction. It is EPA's determination that project construction **may adversely affect chum salmon.**

16.4 Southwestern Washington/Columbia River Sea-Run Cutthroat Trout

Containment of the source of sediment and river contamination (NAPL) is the primary purpose of the barrier wall and eventually the sediment cap. Thus, in the long-term, the remedial action will address unacceptable risks to the environment and public health, and reduce the levels of contamination in sediment. The project's long-term effects will help improve and restore salmon habitat in the Willamette River.

Of the 11 salmonid indicators, the project would result in maintaining or improving baseline conditions. EPA acknowledges, however, that there may be some impacts to sea-run cutthroat trout due the potential to release contaminants during construction. It is EPA's determination that project construction **will not jeopardize** the continued existence of this population.

16.5 Lower Columbia River/Southwest Washington Coho Salmon

Containment of the source of sediment and river contamination (NAPL) is the primary purpose of the barrier wall and eventually the sediment cap. Thus, in the long-term, the remedial action will address unacceptable risks to the environment and public health, and reduce the levels of contamination in sediment. The project's long-term effects will help improve and restore salmon habitat in the Willamette River.

Of the 11 salmonid indicators, the project would result in maintaining or improving baseline conditions. EPA acknowledges, however, that there may be some impacts to coho salmon due the potential to release contaminants during construction. It is EPA's determination that project construction **will not jeopardize** the continued existence of this population.

17. CRITICAL HABITAT

Areas where the physical and/or biological features are essential to the conservation of the listed species are considered critical habitat. The Columbia and Willamette Rivers provide critical feeding, resting, and refugia functions important to the salmonids species covered under this document.

No critical habitat will be adversely impacted by this activity.

18. CONSERVATION MEASURES

The following conservation measures will reduce or eliminate potential impacts to the listed anadromous fish species.

Avoidance/Minimization of Short-Term Effects

- EPA will require that all prudent and necessary steps be taken to assure that no petroleum products, chemicals, or other toxic materials will enter the water from the construction equipment.
- EPA will require that existing shoreline characteristics be maintained to the maximum extent practicable during construction. This includes limiting how the beach areas are accessed by heavy equipment and limiting how much vegetation can be cleared for construction of the sheet pile wall.
- All work will be done in the dry (i.e., out of water), to the extent feasible.
- Construction equipment will be serviced, stored and fueled at least 100 feet away from the shoreline.
- EPA will require the construction contractor to submit a Construction Quality Control Plan and a Spill Prevention Plan. These plans ensure that care will be taken to prevent any petroleum products, chemicals, or other toxic or deleterious materials from entering the water. If a spill occurs, work will stop immediately, steps taken to contain and remove the material, and appropriate agency notification will be made.
- If determined to be necessary, EPA can deploy fish exclusion measures from the most contaminated areas of the site until completion of the sediment remedy. These may include exclusion curtains or booms that limit or prevent fish access to selected areas.
- An absorbent boom will be deployed along the Willamette River shoreline during construction of the sheet pile wall.
- An environmental professional will monitor and document on a daily basis the conditions of the shoreline and nearshore area during construction of the sheet pile wall.
- If an uncontrolled event such as a sizable sheen or seepage is observed, the existing protective measures will be reevaluated for efficacy. If deemed necessary by the environmental professional, work may be stopped until the cause of the event is determined and work can be resumed without additional impacts.

Other Measures

- EPA will continue to work with the appropriate State and Federal agencies to refine construction techniques for the sheet pile wall to be protective of the environment to the maximum extent practicable.
- EPA understands that NFMS/USFWS may not wish to attract sensitive species to this site until all remedial actions are completed. EPA will work with the interested parties to determine any appropriate habitat enhancement measures upon completion of the remedial actions at McCormick and Baxter.

- DEQ will be involved with long-term monitoring of the site, which will include monitoring the efficacy of the subsurface barrier wall.

19. EFFECTS OF THE ACTION ON OTHER LISTED SPECIES

19.1 Bald Eagle (*Haliaeetus leucocephalus*)

The bald eagle is found along the shores of saltwater, and freshwater lakes and rivers. In Oregon, breeding territories are located in predominantly coniferous, uneven-aged stands with old-growth components. Territory size and configuration are influenced by a variety of habitat characteristics, including availability and location of perch trees for foraging, quality of foraging habitat, and distance of nests from waters supporting adequate food supplies. Habitat models for nesting bald eagles in Maine show that the eagles select areas with (1) suitable forest structure, (2) low human disturbance, and (3) highly diverse or accessible prey (Rodrick and Milner 1991).

Bald eagles typically build nests in mature old-growth trees, which are generally used in successive years. In Oregon, courtship and nest-building activities generally begin in January and February. Egg laying begins in March or early April, with eaglets hatching in mid-April or early May. Eaglets usually fledge in mid-July and often remain in the vicinity of the nest for another month (Rodrick and Milner 1991).

Bald eagles are year-round residents in the vicinity of the project area; however, there are no nests within two miles of the project site (Pers Comm ODFW).

Bald eagles are adaptable, feeding on whatever is most expedient. Eagles often depend on dead or weakened prey, and their diet may vary locally and seasonally. Various carrion, including spawned salmon taken from gravel bars along wide, braided river stretches, serve as important food items during fall and winter. Waterfowl often are taken as well. Anadromous and warm-water fishes, small mammals, carrion, and seabirds are consumed during the breeding season (Rodrick and Milner 1991). On the Willamette River, the most likely food resource items are gulls, waterfowl, and fish (USFWS and NOAA 1996).

Occurrence in the Project Area. Bald eagle may use the project for foraging and feeding.

Analysis of Effects. The effect of the proposed action to bald eagles may be disturbed by noise during construction. It is likely that the eagles will avoid the immediate area.

Any interference with eagle activity will end when construction is completed. The effects are expected to be localized and temporary. In addition, local bald eagle populations are likely acclimated to various human activities as this is a heavily industrialized area. Long-term degradation of eagle habitat is not expected. Survival and reproductive success of eagles will be unaffected. Containment of the NAPL source producing contaminated sediment will incrementally reduce the extent of possible exposure to hazardous substances.

Cumulative, Interrelated or Interdependent Effects. There would be no significant cumulative, interrelated or interdependent effects on this species from the proposed project in conjunction with other projects or actions.

Conservation Methods. Conservation methods listed in Section 18 will also serve to minimize potential effects on bald eagles. No additional conservation measures are warranted.

Effect Determination. The proposed action will not result in any long-term degradation of habitat or other adverse effects on bald eagles. Short-term effects such as noise disturbance and reduced prey availability will not occur or will be very small in magnitude. The survival or reproductive success of eagles in the project vicinity would not be affected. Therefore, the proposed action **may affect, but is not likely to adversely affect the bald eagle**.

19.2 Golden Paintbrush (*Castilleja levisecta*)

Castilleja levisecta is the only yellow-bracted Indian paintbrush in the Willamette Valley-Puget Trough ranges. It grows from a perennial base to over twelve inches high, and is covered with a soft pubescence. Its leaves, closely ascending to the stalk, are narrowly oblong with one to four pair of short lobes near the tip. They are about one to one and one-half inches long and turn reddish with age. The bright yellow bracts, also turning to reddish-orange with age, are oblong with one to two pairs of short lobes. The flowers barely extend beyond the bracts. It blooms from April through August (Eastman 1990). *C. levisecta* occurs in open grasslands at elevations below 328 feet around the periphery of the Puget Trough. Most populations occur on glacially derived soils, either gravelly glacial outwash or clayey glacio-lacustrine sediments (Sheehan and Sprague 1984, Gamon 1995).

Occurrence in the Project Area. *C. levisecta* historically occurred in the grasslands and prairie of the Willamette Valley in Oregon and was once quite common in Linn, Marion and Multnomah Counties (Sheehan and Sprague 1984, Gamon 1995). However, it is now probably extinct in Oregon (Eastman 1990) with only ten known populations in western Washington. The southern most population is just south of Olympia, Washington (50 CFR Part 17). The project site has been heavily disturbed though filling, grading, and other industrial oriented land uses. There are no known individuals or populations at or near the project area.

Analysis of Effects. The actions proposed for the project site would not directly or indirectly impact areas known to support or potentially support individuals or populations of *C. levisecta.*

Cumulative, Interrelated or Interdependent Effects. There would be no cumulative, interrelated or interdependent effects as a result of this action.

Conservation Methods. None

Effect Determination. The action would have **no effect** on *C. levisecta*

19.3 Water Howellia (*Howellia aquatilis*)

Howellia aquatilis (water howellia) is an aquatic annual plant that grows 4 to 24 inches height. It has extensively branched, submerged or floating stems with narrow leaves 0.4 to 2 inches in length. Two types of flowers are produced: small, inconspicuous flowers beneath the water's surface, and emergent white flowers. (Shelly and Moseley 1988).

H. aquatilis grows in firm consolidated clay and organic sediments that occur in wetlands associated with ephemeral glacial pothole ponds and former river oxbows (Shelly and Moseley 1988; Lesica 1992). Spring rains and snowmelt run-off fill these wetland habitats, which, depending on temperature and precipitation, exhibit some drying during the growing season. This plant's microhabitats include shallow water, and the edges of deep ponds that are partially surrounded by deciduous trees (Shelly and Moseley 1988; Gamon 1992).

Occurrence in the Project Area. *H. aquatilis* historically occurred over a large area of the Pacific Northwest region of the United States, but today the species is found only in specific habitats within the Pacific Northwest (Shelly and Moseley 1988; Gamon 1992). At present it is known in only two sites in Washington (Clark County and Spokane County) and several locations in Montana. It is thought to be extinct in Oregon (Eastman 1990).

Analysis of Effects. The actions proposed for the project site would not directly or indirectly impact areas known to support or potentially support individuals or populations of *H. aquatilis*

Cumulative, Interrelated or Interdependent Effects. There would be no cumulative, interrelated or interdependent effects as a result of this action.

Conservation Methods. None

Effect Determination. The action would have **no effect** on *Howellia aquatilis.*

19.4 Bradshaw's lomatium (*Lomatium bradshawii*)

Lomatium bradshawii is a low, erect perennial with finely divided leaves and grows from 8 to 20 inches tall. The flowers are yellow, small and compact and subtended by green bracts. It blooms in April and May.

Occurrence in the Project Area. *L. bradshawii* is endemic to the central and southern portions of the Willamette Valley in western Oregon and was once widespread in the wet, open grasslands. It is now limited to a few sites in Lane, Marion, and Benton Counties. There are no known individuals or populations of *L. bradshawii* at the project site.

Analysis of Effects. The actions proposed for the project site would not directly or indirectly impact areas known to support or potentially support individuals or populations of *L. bradshawii.*

Cumulative, Interrelated or Interdependent Effects. There would be no cumulative, interrelated or interdependent effects as a result of this action.

Conservation Methods. None

Effect Determination. The action would have **no effect** on *Lomatium bradshawii.*

19.5 Nelson's Checker Mallow (*Sidalcea nelsoniana)*

Sidalcea nelsoniana is a perennial herb with pinkish-lavender to pinkish-purple flowers born in clusters at the end of 1 to 2.5 tall stems. Flowering can occur as early as mid-May and extend into September in the Willamette Valley, depending on weather and site conditions. The range of the plant extends from southern Benton County, Oregon, and north to Cowlitz County, Washington, and from central Linn County, Oregon, west to just west of the crest of the Coast Range (Eastman 1990).

Occurrence in the Project Area. *S. nelsoniana* was once very occasional in the Willamette Valley, Oregon, from Linn and Benton Counties north to near Portland and westward to eastern Tillamook County, but mainly occurred in Marion County, on more or less gravelly, well-drained soils (Hitchcock 1957). Others have described the plant as growing on moist to dry sites with poorly drained to well drained clay, clay loam, and gravelly loam soils, in meadow, and rarely, wooded habitats (CH2M Hill 1986, Glad et al 1987). *S. nelsoniana* is occasionally found in areas where prairie or grassland remnants persist, such as along fence rows, drainage swales, and at the edges of plowed fields adjacent to wooded areas.

Within the Willamette Valley, *S. nelsoniana* most frequently occurs in ash swales and meadows with wet depressions, or along streams. It also grows in wetlands within remnant prairie grasslands. Some sites occur along roadsides at stream crossings (Bureau of Land Management 1985). There are no known individuals or populations of *S. nelsoniana* at the project site.

Analysis of Effects. The actions proposed for the project site would not directly or indirectly impact areas known to support or potentially support individuals or populations of *S. nelsoniana.*

Cumulative, Interrelated or Interdependent Effects. There would be no cumulative, interrelated or interdependent effects as a result of this action.

Conservation Methods. None

Effect Determination. The action would have **no effect** on *Sidalcia nelsoniana*

19.6 Willamette Daisy (Erigeron decumbens var. decumbens)

Erigeron decumbens var. decumbens (hereafter *E. decumbens*) is a perennial plant, growing 6 to 28 inches tall. The leaves are linear and long, both basal and cauline; most of them are triple nerved. The cauline leaves are only gradually reduced in size and extend nearly to the flowering heads. The heads may be one or many, and each has from twenty to fifty blue or lilac ray flowers that are about ½ inch long. The disk flowers are yellow. It blooms from June into early July. Habitat for *E. decumbens* is native wetland prairie (Eastman 1990).

Occurrence in the Project Area. This once was a very common plant on the native Willamette valley prairies. It nearly became extinct through the conversion of native prairie to agricultural land (Eastman 1990). *E. decumbens* is now limited to approximately 28 sites of remnant grasslands throughout the Willamette Valley (50 CFR 17 RIN 1018-AE53). There are no known individuals or populations of *E. decumbens* at the project site.

Analysis of Effects. The actions proposed for the project site would not directly or indirectly impact areas known to support or potentially support individuals or populations of *E. decumbens.*

Cumulative, Interrelated or Interdependent Effects. There would be no cumulative, interrelated or interdependent effects as a result of this action.

Conservation Methods. None

Effect Determination. The action would have **no effect** on *Erigeron decumbens var. decumbens.*

19.7 Kincaid's Lupine (Lupinus sulphureus var. kincaidii)

Lupinus sulphureus var. kincaidii (hereafter *L. sulphureus*) is easily distinguished from other lupines because of its low growing habit and unbranched inflorescence. The flowers are slightly reflexed with a distinct ruffled banner petal and are yellowish-cream colored, often with blue keels. The plants are 16 to 32 inches tall, with single to multiple unbranched flowering stems and basal leaves that remain after flowering. It is typically found in native upland prairie in the Willamette Valley.

Occurrence in the Project Area. Like the Willamette daisy (*Erigeron decumbens*), *L. sulphureus* was once common on the native Willamette Valley upland prairies. It is now limited to 62 remnant prairies throughout the Willamette Valley and south into Douglas County (50 CFR 17 RIN 1018-AE53). There are no known individuals or populations of *L. sulphureus* at the project site.

Analysis of Effects. The actions proposed for the project site would not directly or indirectly impact areas known to support or potentially support individuals or populations of *L. sulphureus.*

Cumulative, Interrelated or Interdependent Effects. There would be no cumulative, interrelated or interdependent effects as a result of this action.

Conservation Methods. None

Effect Determination. The action would have **no effect** on *Lupinus sulphureus var. kincaidii.*

19.8 Oregon Spotted Frog (*Rana pretiosa*)

The Oregon spotted frog is nearly always found in or near a perennial water body such as a spring, pong, or lake or sluggish stream. It is most often associated with nonwoody wetland plant communities (i.e., wet meadows). Breeding occurs sometime in February or March at lower elevations and not until late May or June at higher elevations. Males are not territorial and may gather in large groups of 25 or more individuals at specific locations in the pond. Females usually lay their eggs adjacent to or melded with other egg masses. The gelatinous masses are only partially submerged. Eggs are deposited in the same locations in successive years. Sometime during their first summer, the tadpoles transform into tiny froglets about ¾ inch in length (Leonard et al 1993).

Occurrence in the Project Area. The Oregon spotted frog is currently found in parts of the Cascade Mountains and areas of eastern and central Washington and Oregon. Prior to 1940, the Oregon spotted frog was found in portions of the Puget Sound Trough and the Willamette Valley. They now appear to have been virtually eliminated from these areas (Leonard et al 1993). There are no known individuals or populations of Oregon spotted frog at the project site.

Analysis of Effects. The actions proposed for the project site would not directly or indirectly impact areas known to support or potentially support individuals or populations of Oregon spotted fog.

Cumulative, Interrelated or Interdependent Effects. There would be no cumulative, interrelated or interdependent effects as a result of this action.

Conservation Methods. None

Effect Determination. The action would have **no** effect on Oregon spotted frog.

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Site Location McCormick & Baxter Creosoting Company Superfund Site

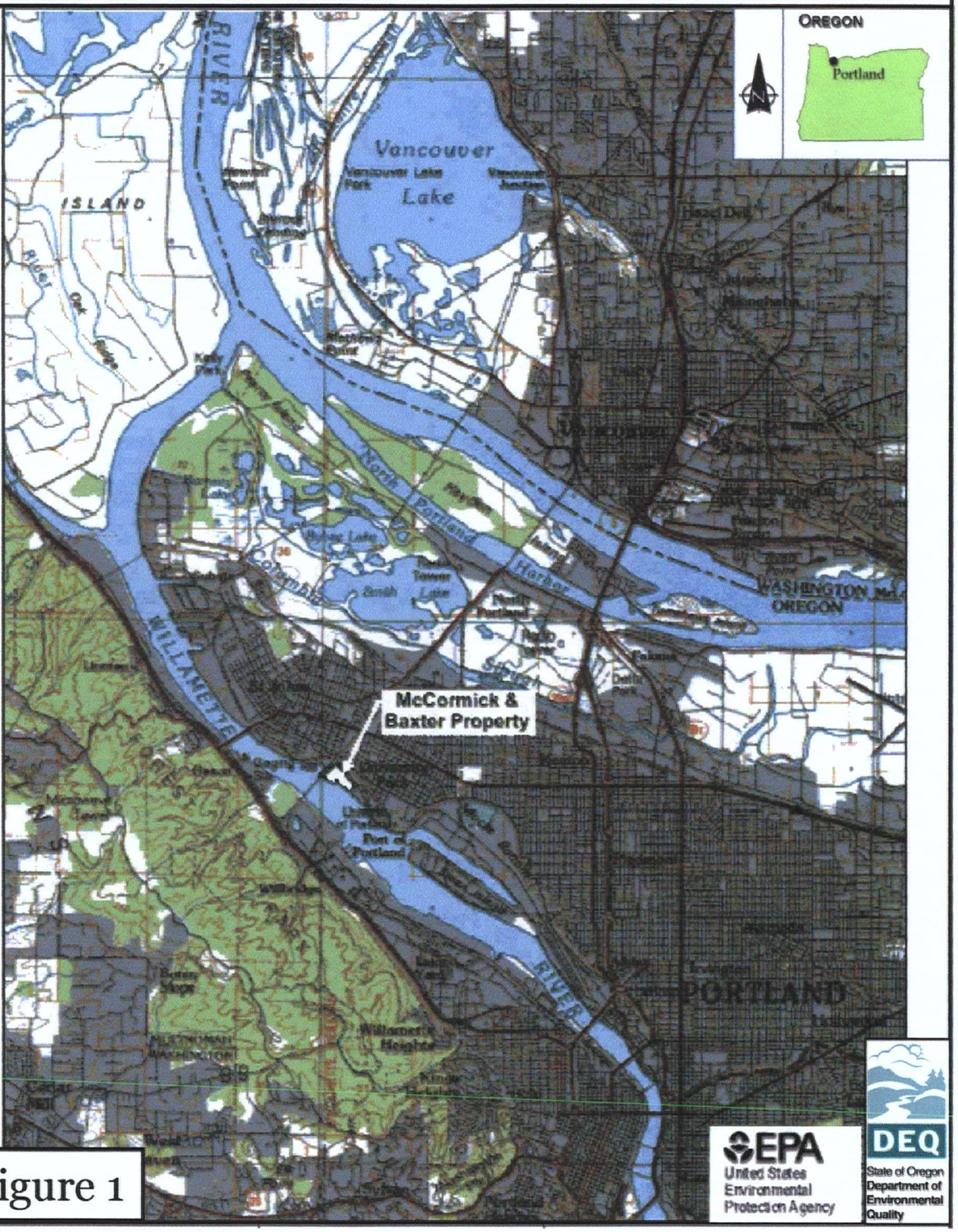

Figure 1

McCormick & Baxter Superfund Site
Current Site Features

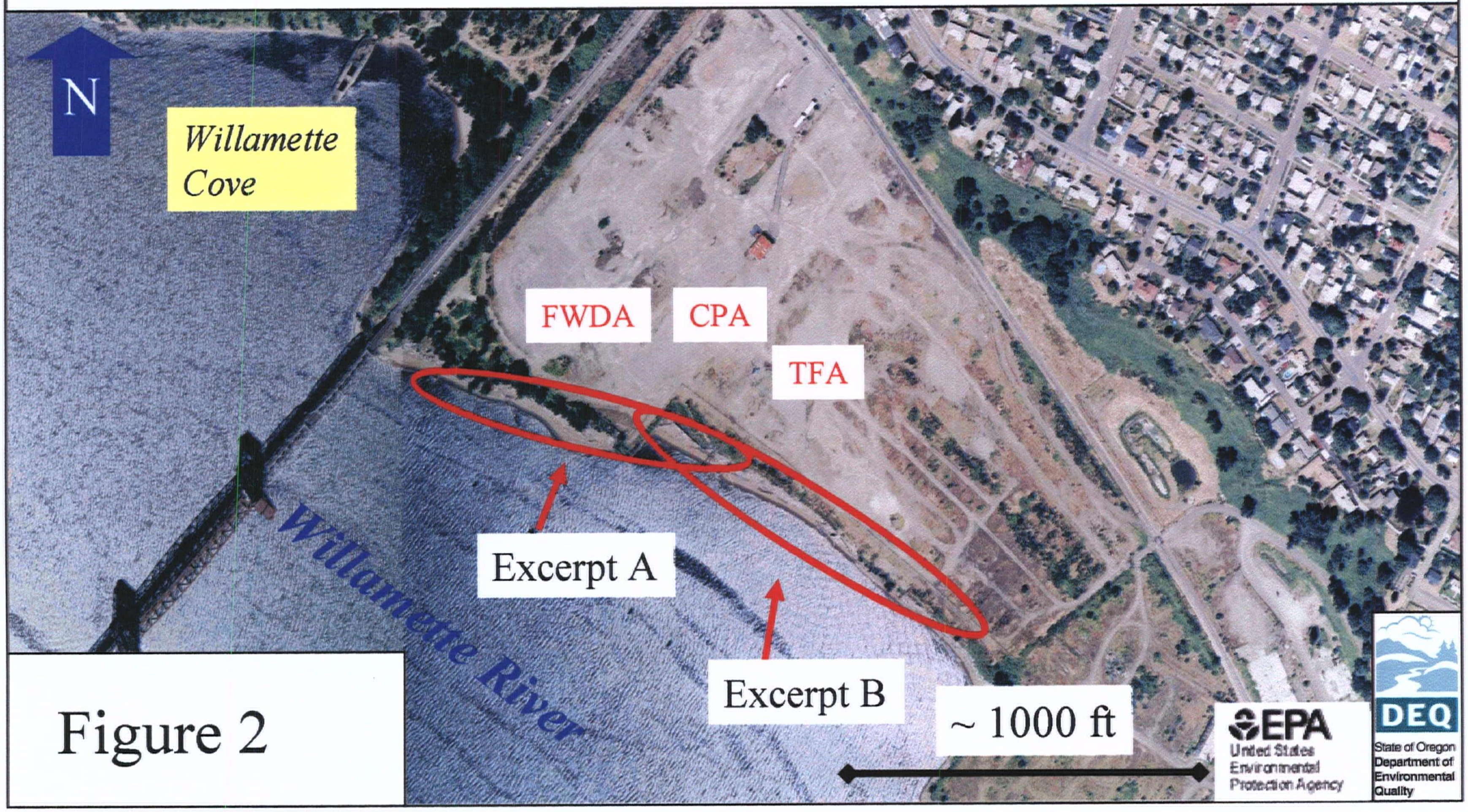

Figure 2

Shoreline Facing East, Southeast
(Excerpt A from Figure 2)

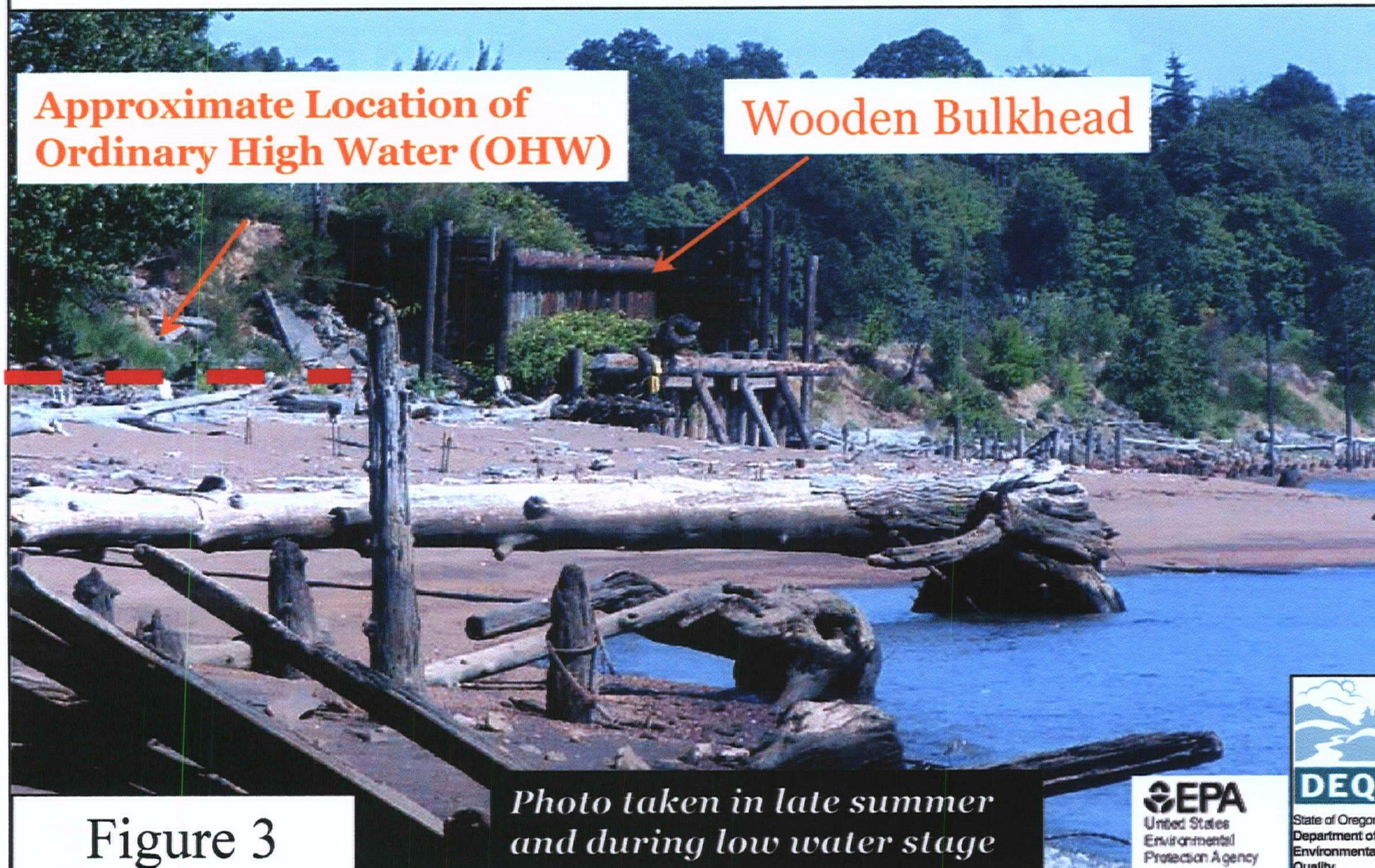

Figure 3

Shoreline Facing Southeast
(Excerpt B from Figure 2)

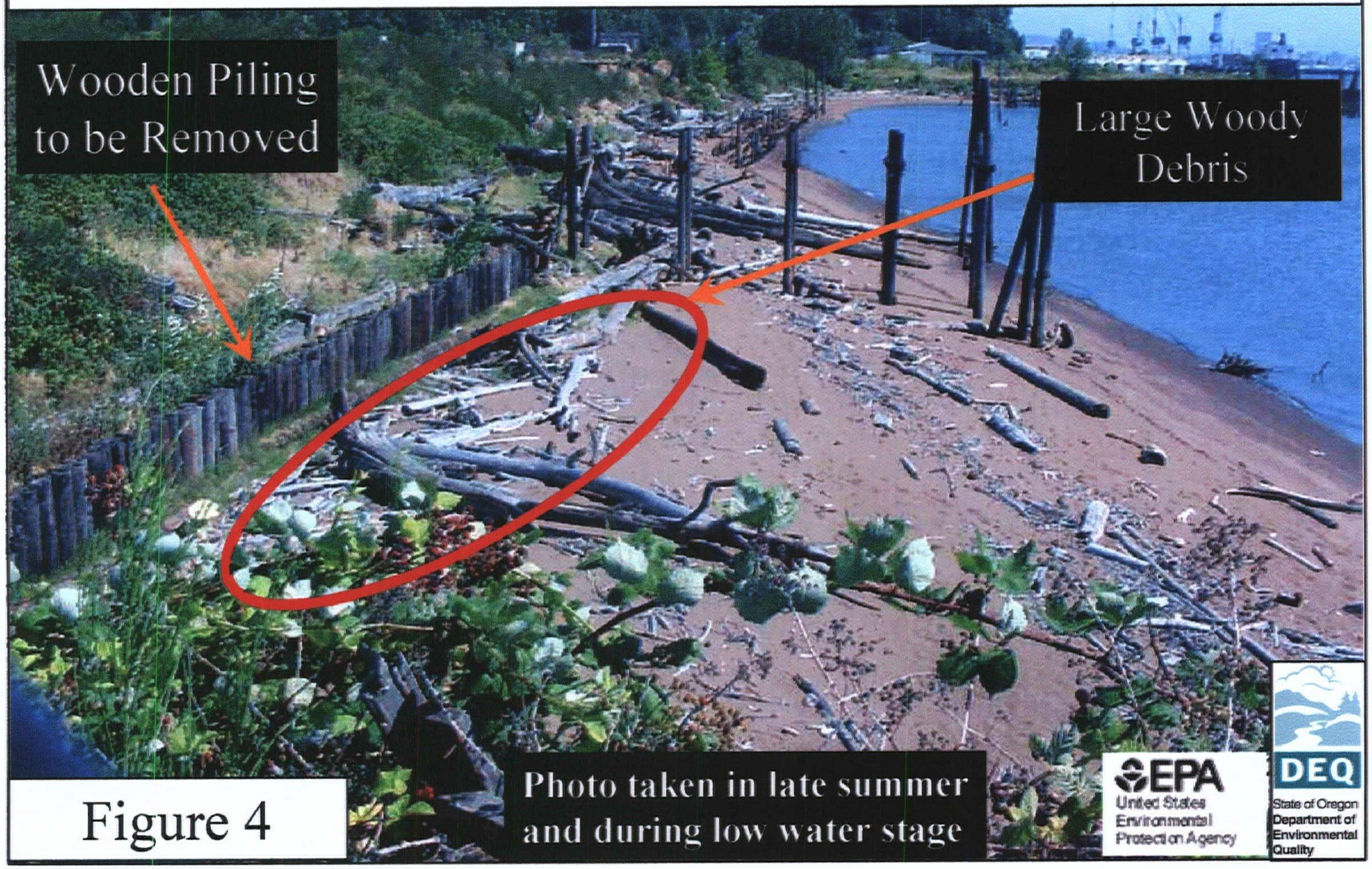

Figure 4

Barrier Wall Alignment

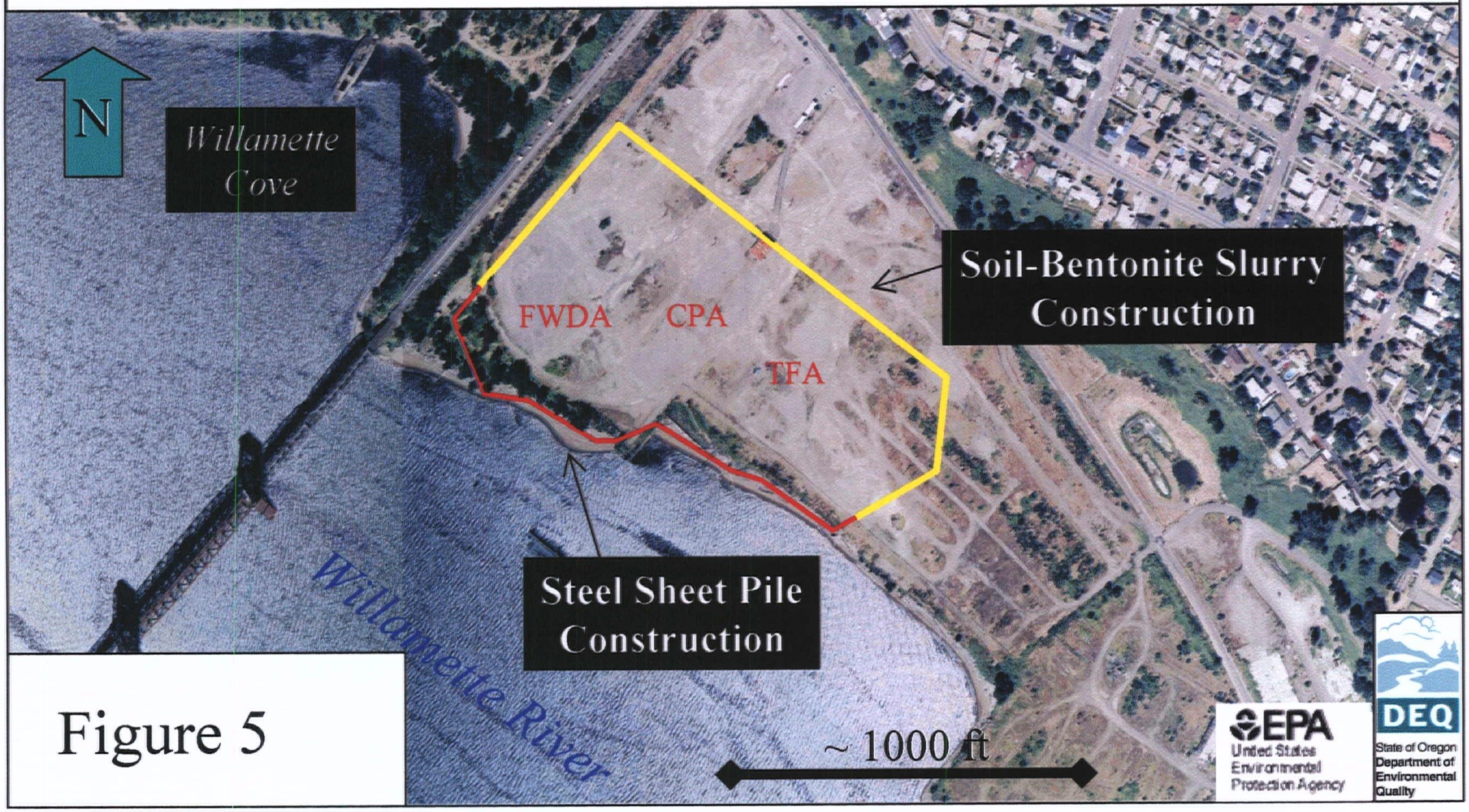

Figure 5

Willamette River Stage

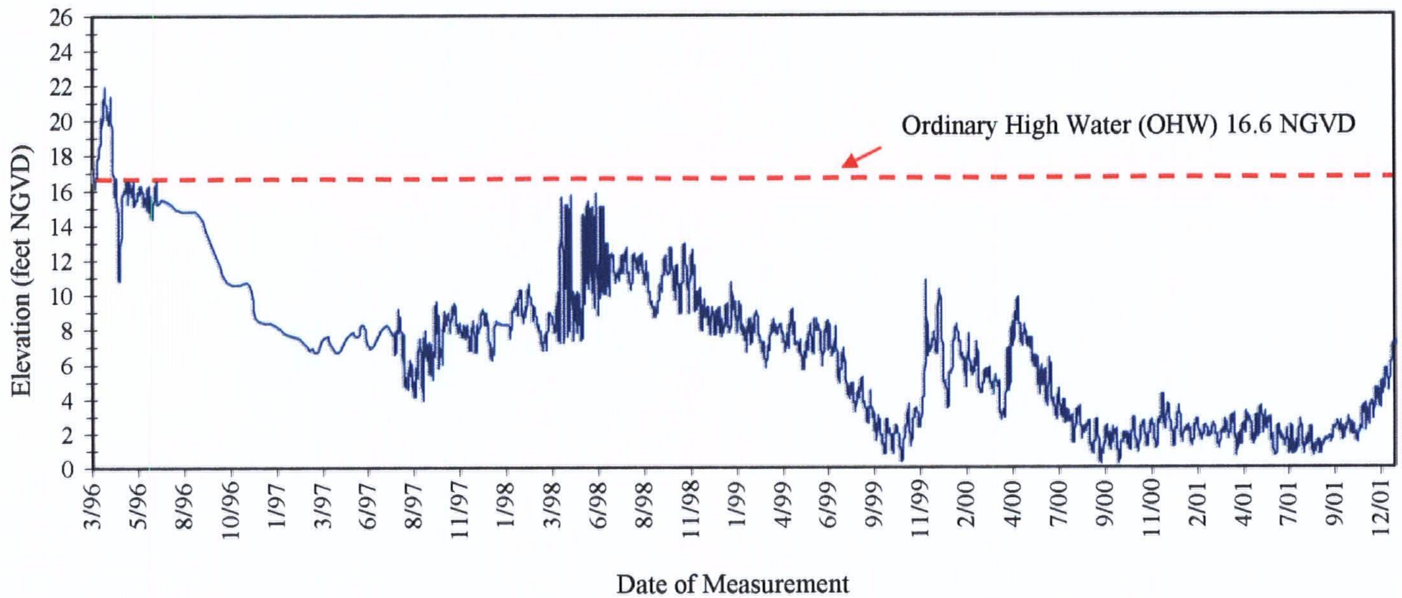

Figure 6

Measurements are from the Morrison Bridge (~River Mile 13) and corrected for elevation change in front of M&B site (River Mile 7). Data were also correlated with river stage data collected across the river at the Willbridge Terminal.

EPA United States Environmental Protection Agency

DEQ State of Oregon Department of Environmental Quality